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Mission Bay

FINAL ENVIRONMENTAL IMPACT REPORT

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VOLUME THREE
Appendices

CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF CITY PLANNING

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Mission Bay
Final
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APPENDIX A: THE EIR ALTERNATIVES

TABLE XIV.A.1: ZONING CHARACTERIZATION OF MISSION BAY ALTERNATIVES

Land Use/a/	Zoning Characterization/b/	Alternative A	Alternative B	Alternative N
Office	Community Business	C-2	C-2	NA
	Heavy Commercial	NA	NA	CM
	Floor Area Ratio/c/	5 to 1	5 to 1	9 to 1
	Height and Bulk Characterization/d/	110-C	110-C	105-F
	Maximum Number of Floors	8	8	NA
	Associated Public Open Space/e/	15-20%	15-20%	None
S/LI/RD	Heavy Industrial	M-2	M-2	NA
	Floor Area Ratio	5 to 1	5 to 1	
	Height and Bulk Characterization	60-X	60-X	
	Maximum Number of Floors	4	4	
	Associated Public Open Space	10-15%	10-15%	
Retail	Community Business	C-2	C-2	M-2
	Floor Area Ratio	5 to 1	5 to 1	5 to 1
	Height and Bulk Characterization	50-X	50-X	80-B
	Maximum Number of Floors	NA	NA	NA
	Associated Public Open Space	None	None	None
Hotel	Community Business	C-2	NA	NA
	Floor Area Ratio	5 to 1		
	Height and Bulk Characterization	110-C		
	Maximum Number of Floors	8		
	Associated Public Open Space	None		
Port-Related/ M-2	Heavy Industrial	M-2	NA	NA
	Floor Area Ratio	5 to 1		
	Height and Bulk Characterization	40-X		
	Maximum Number of Floors	NA		
	Associated Public Open Space	None		
M-2/Industrial	Heavy Industrial	NA	NA	M-2
	Average Floor Area Ratio			5 to 1
	Height and Bulk Characterization			/f/
	Maximum Number of Floors			NA
	Associated Public Open Space			None
HDR	Residential, Mixed: High Density	RM-4	NA	NA
HDR w/Retail (Up to 150 units/acre)	Residential-Commercial/Combined High Density	RC-4	NA	NA
	Height and Bulk Characterization	110-B		
	Maximum Number of Floors	8		
	Associated Public Open Space	5%		

(continued)

TABLE XIV.A.1: ZONING CHARACTERIZATION OF MISSION BAY ALTERNATIVES (continued)

Land Use/a/	Zoning Characterization/b/	Alternative A	Alternative B	Alternative N
MHDR	Residential, Mixed: Medium Density	RM-3	RM-3	NA
MHDR w/Retail	Residential-Commercial/Combined			
(Up to 120	Medium Density	NA	RC/3	NA
units/acre)	Height and Bulk Characterization	90-B	90-B	
	Maximum Number of Floors	8	8	
	Associated Public Open Space	5%	5%	
MDR	Residential, Mixed: Medium Density	RM-3	RM-3	NA
MDR w/Retail	Residential-Commercial/Combined			
(Up to 85	Medium Density	NA	RC/3	NA
units/acre)	Height and Bulk Characterization	70-B	70-B	
	Maximum Number of Floors	6	6	
	Associated Public Open Space	5%	5%	
LDR	Residential, Mixed: Low Density	RM-1	RM-1	NA
LDR w/Retail	Residential-Commercial/Combined			
(Up to 50	Low Density	NA	RC-1	NA
units/acre)	Height and Bulk Characterization	50-X	50-X	
	Maximum Number of Floors	4	4	
	Associated Public Open Space	5%	5%	
Community Facilities	Public	P	P	M-2
	Floor Area Ratio	NA	NA	NA
	Height and Bulk Characterization	70-A	70-A	80-B
	Maximum Number of Floors	6	6	None
Open Space	Open Space	OS	OS	OS
Train Station & Related Trackage/g/	Heavy Industrial	M-2	M-2	M-2

NA - Not applicable.

/a/ The land uses are described in V. The EIR Alternatives and Approval Process, starting on p. V.1.

/b/ The zoning characterizations are the Use Districts described in San Francisco City Planning Code Article 2 that would accommodate land uses proposed for each Alternative. The Use Districts have not been specifically proposed for Alternatives A and B; they were developed for purposes of analysis. The Use Districts listed for Alternative N are the existing districts. See Figures XIV.A.1, XIV.A.3 and XIV.A.5, pp. XIV.A.4, XIV.A.6, and XIV.A.8.

(continued)

TABLE XIV.A.1: ZONING CHARACTERIZATION OF MISSION BAY ALTERNATIVES (continued)

/c/ Floor Area Ratio (FAR) is the ratio of gross floor area of a building to site area. City Planning Code Article 2 specifies FAR for various Use Districts. The FARs given for Alternatives A and B reflect assumptions made for purposes of analysis in this EIR and are not necessarily those in the Planning Code for the Use District specified.

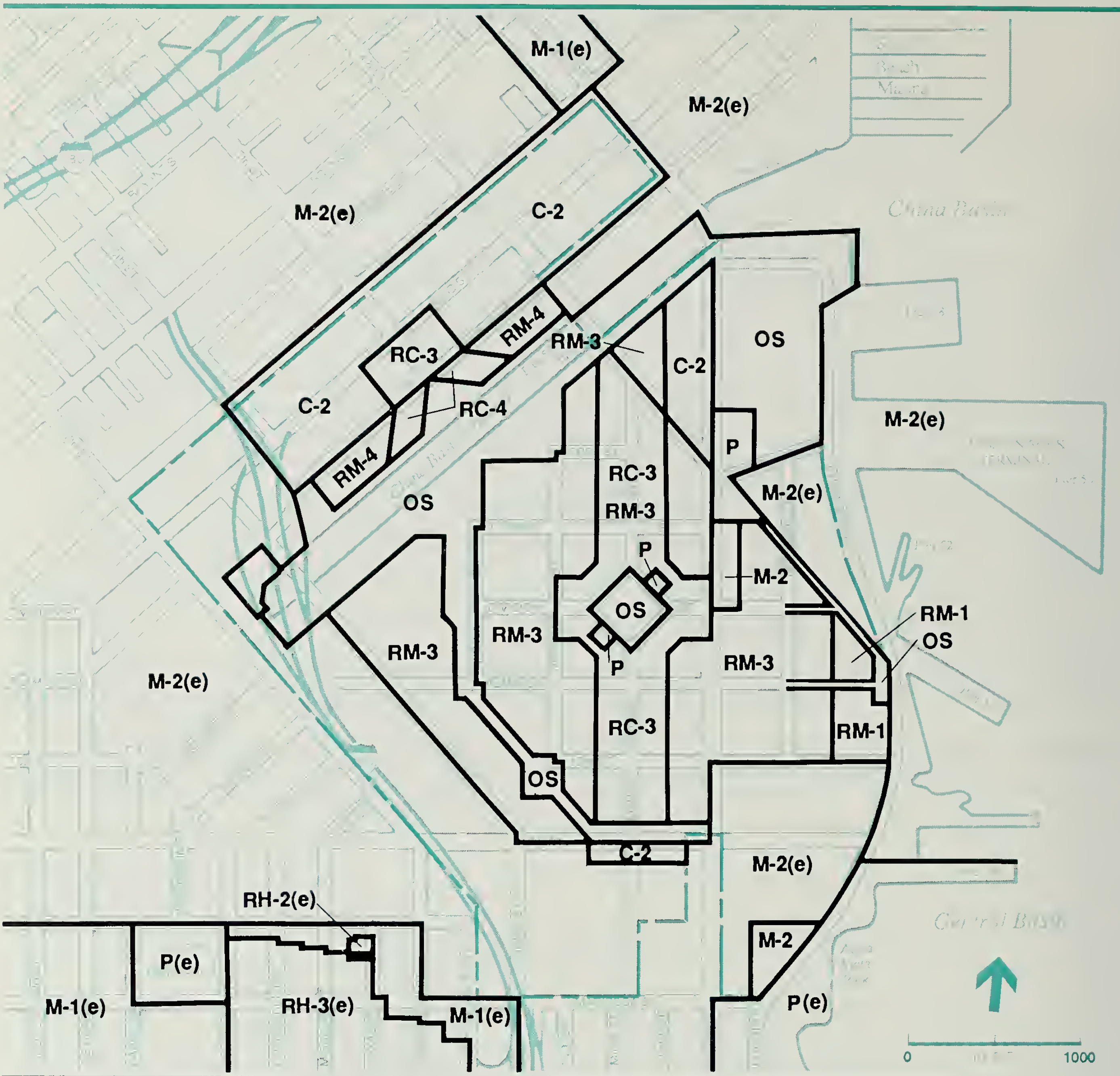
/d/ The height and bulk characterizations are Height and Bulk Districts described in City Planning Code Article 2.5 that would accommodate the land uses proposed for each Alternative. The Height and Bulk Districts have not been specifically proposed for Alternatives A and B; they were developed for purposes of analysis. The Height and Bulk Districts listed for Alternative N are existing districts. See Figures XIV.A.2, XIV.A.4 and XIV.A.6, pp. XIV.A.5, XIV.A.7, and XIV.A.9.

/e/ Open space is the percent of site area assumed in the EIR to be publicly accessible open space for Alterntives A and B, and specifed in the City Planning Code for Alternative N.

/f/ The Project Area includes a number of existing Height and Bulk Districts, illustrated on Figure XIV.A.6, p. XIV.A.9.

/g/ CalTrain rail service uses are assumed to include trackage and a one-story commute terminal. FAR, height and bulk and number of floors characteristics would not apply.

SOURCE: Roger Owen Boyer & Associates and Environmental Science Associates, Inc.



MISSION BAY BOUNDARY

C-2	COMMUNITY BUSINESS	RM-4	RESIDENTIAL , MIXED: HIGH DENSITY
M-1	LIGHT INDUSTRIAL	RH-2	RESIDENTIAL, HOUSE: TWO FAMILY
M-2	HEAVY INDUSTRIAL	RH-3	RESIDENTIAL, HOUSE: THREE FAMILY
RC-3	RESIDENTIAL-COMMERCIAL COMBINED: MEDIUM DENSITY	OS	OPEN SPACE
RC-4	RESIDENTIAL-COMMERCIAL COMBINED: HIGH DENSITY	P	PUBLIC USE
RM-1	RESIDENTIAL, MIXED: LOW DENSITY		
RM-3	RESIDENTIAL, MIXED: MEDIUM DENSITY	(e)	EXISTING USE DISTRICT

NOTE: The zoning characteristics indicated in the Project Area reflect Use Districts defined in City Planning Code Article 2 that would accommodate the uses proposed for Alternative A. These Use Districts have not been specifically proposed for Alternative A; they are assumptions developed for purposes of analysis. See Table XIV.A.1.

Mission Bay

SOURCE: Environmental Science Associates, Inc. and Roger Owen Boyer and Associates

FIGURE XIV.A.1
USE DISTRICT CHARACTERIZATION - ALTERNATIVE A

MISSION BAY BOUNDARY (e) EXISTING HEIGHT AND BULK DISTRICT

NUMBERS INDICATE HEIGHT LIMITS IN FEET. LETTERS INDICATE BULK LIMITS AS FOLLOWS:

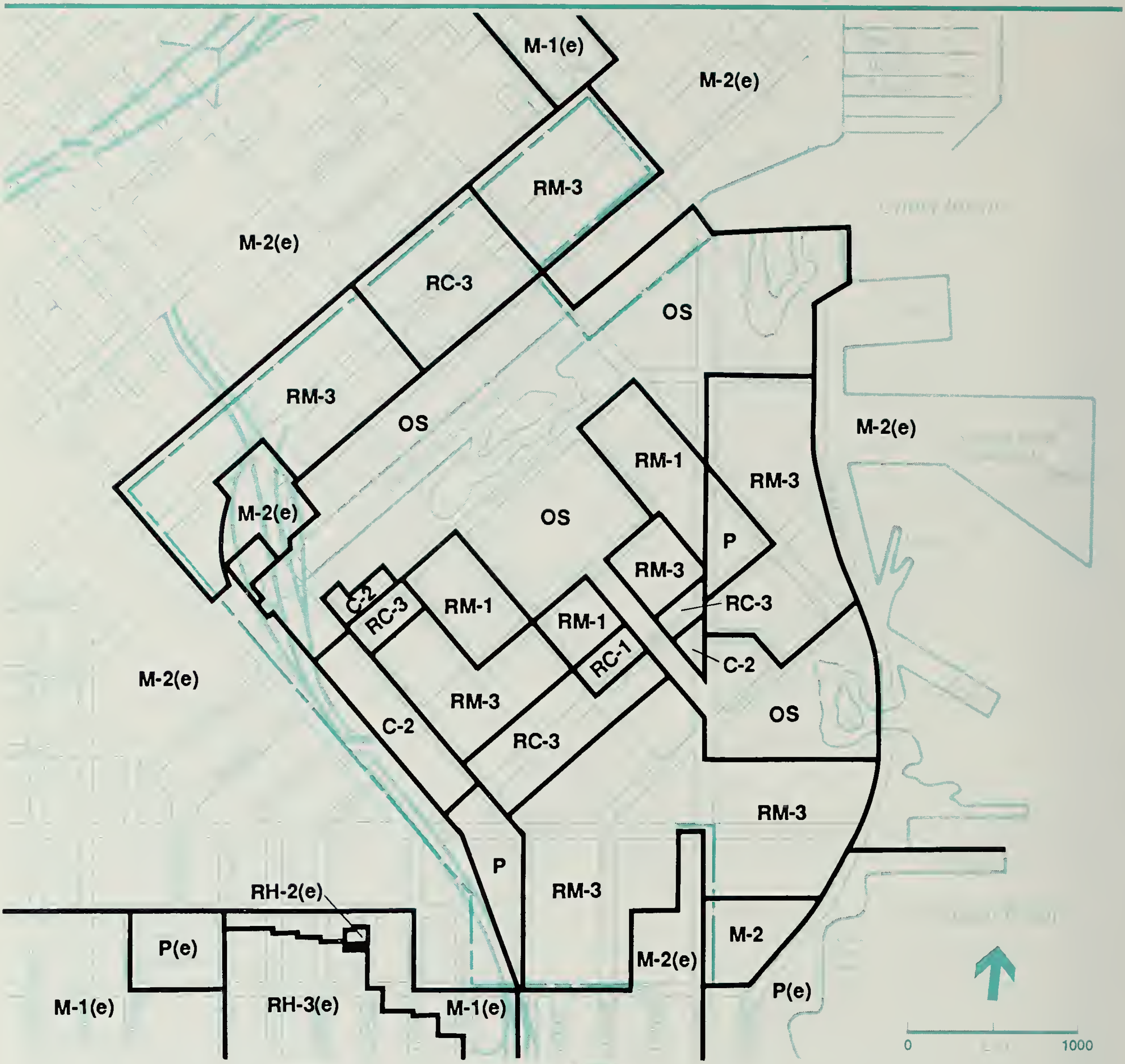
Letter	Height above which Maximum Dimensions Apply	Maximum Building Length	Maximum Diagonal Dimension
A	40	110	125
B	50	110	125
C	80	110	125
F	80	110	140
X	Bulk Limits Not Applicable		
OS	See City Planning Code Section 290		

NOTE: The Height and Bulk Districts characterizations indicated in the Project Area reflect districts defined in Article 2.5 of the City Planning Code that would accommodate the uses proposed in Alternative A. See Table XIV.A.1. These Height and Bulk Districts have not been specifically proposed for Alternative A; they are assumptions developed for purposes of analysis.

Mission Bay

SOURCE: Environmental Science Associates, Inc. and Roger Owen Boyer and Associates

FIGURE XIV.A.2
HEIGHT AND BULK DISTRICT CHARACTERIZATION - ALTERNATIVE A



MISSION BAY BOUNDARY

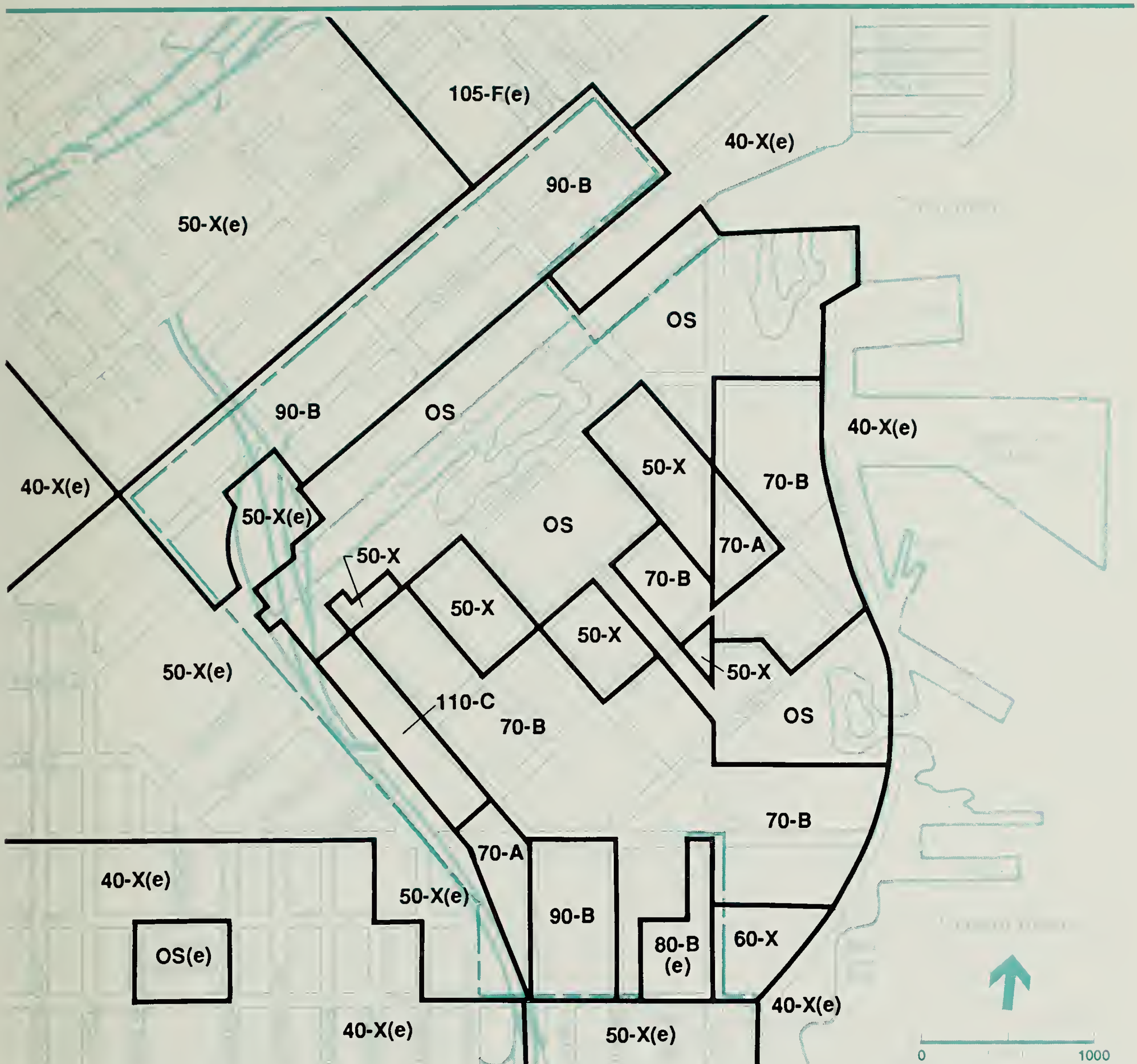
C-2	COMMUNITY BUSINESS	RM-3	RESIDENTIAL, MIXED: MEDIUM DENSITY
M-1	LIGHT INDUSTRIAL	RH-2	RESIDENTIAL, HOUSE: TWO FAMILY
M-2	HEAVY INDUSTRIAL	RH-3	RESIDENTIAL, HOUSE: THREE FAMILY
RC-1	RESIDENTIAL-COMMERCIAL COMBINED: LOW DENSITY	OS	OPEN SPACE
RC-3	RESIDENTIAL-COMMERCIAL COMBINED: MEDIUM DENSITY	P	PUBLIC USE
RM-1	RESIDENTIAL, MIXED: LOW DENSITY		
		(e)	EXISTING USE DISTRICT

NOTE: The zoning characteristics indicated in the Project Area reflect Use Districts defined in City Planning Code Article 2 that would accommodate the uses proposed for Alternative B. These Use Districts have not been specifically proposed for Alternative B; they are assumptions developed for purposes of analysis. See Table XIV.A.1

Mission Bay

SOURCE: Environmental Science Associates, Inc. and Roger Owen Boyer and Associates

FIGURE XIV.A.3
USE DISTRICT CHARACTERIZATION - ALTERNATIVE B



MISSION BAY BOUNDARY

(e) EXISTING HEIGHT AND BULK DISTRICT

NUMBERS INDICATE HEIGHT LIMITS IN FEET. LETTERS INDICATE BULK LIMITS AS FOLLOWS:

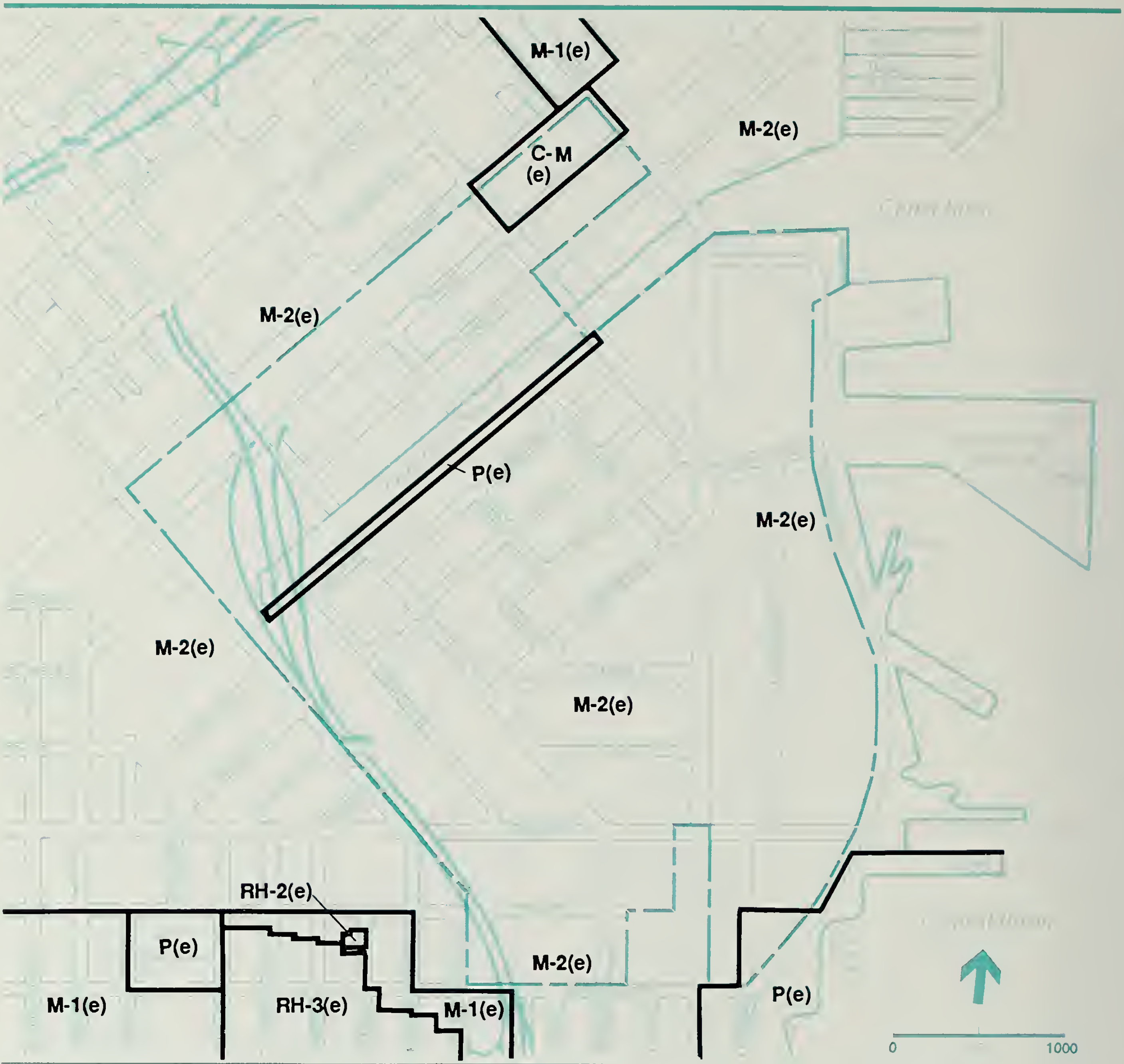
Letter	Height above which Maximum Dimensions Apply	Maximum Building Length	Maximum Diagonal Dimension
A	40	110	125
B	50	110	125
C	80	110	125
F	80	110	140
X	Bulk Limits Not Applicable		
OS	See City Planning Code Section 290		

NOTE: The Height and Bulk Districts characterizations indicated in the Project Area reflect districts defined in Article 2.5 of the City Planning Code that would accommodate the uses proposed in Alternative B. See Table XIV.A.1. These Height and Bulk Districs have not been specifically proposed for Alternative B; they are assumptions developed for purposes of analysis.

Mission Bay

SOURCE: Environmental Science Associates, Inc. and Roger Owen Boyer and Associates

FIGURE XIV.A.4
HEIGHT AND BULK DISTRICT CHARACTERIZATION - ALTERNATIVE B



MISSION BAY BOUNDARY

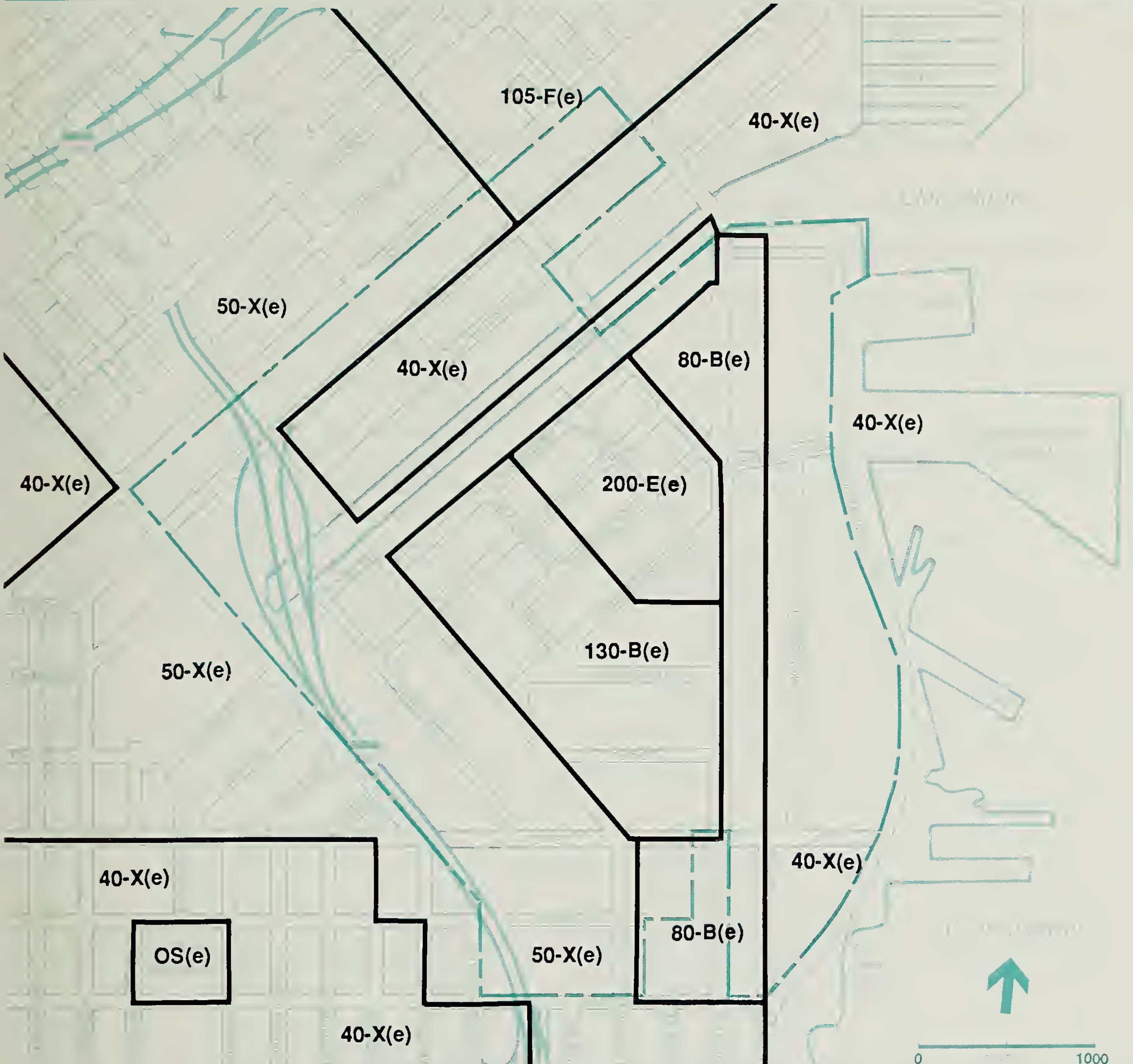
C-M	HEAVY COMMERCIAL	RH-2	RESIDENTIAL, HOUSE: TWO FAMILY
M-1	LIGHT INDUSTRIAL	RH-3	RESIDENTIAL, HOUSE: THREE FAMILY
M-2	HEAVY INDUSTRIAL	P	PUBLIC USE
		(e)	EXISTING USE DISTRICT

NOTE: The Use Districts indicated are the existing designations as defined in City Planning Code Article 2. See Table XIV.A.1.

Mission Bay

FIGURE XIV.A.5
USE DISTRICTS - ALTERNATIVE N

SOURCE: Environmental Science Associates, Inc. and Roger Owen Boyer and Associates



MISSION BAY BOUNDARY

(e) EXISTING HEIGHT AND BULK DISTRICT

NUMBERS INDICATE HEIGHT LIMITS IN FEET. LETTERS INDICATE BULK LIMITS AS FOLLOWS:

Letter	Height above which Maximum Dimensions Apply	Maximum Building Length	Maximum Diagonal Dimension
B	50	110	125
E	65	140	140
F	80	110	140
X	Bulk Limits Not Applicable		
OS	See City Planning Code Section 290		

NOTE: The Height and Bulk Districts indicated are the existing districts as defined in City Planning Code Article 2.5. See Table XIV.A.1.

Mission Bay

SOURCE: Environmental Science Associates, Inc. and Roger Owen Boyer and Associates

FIGURE XIV.A.6
HEIGHT AND BULK DISTRICTS - ALTERNATIVE N

TABLE XIV.A.2: DENSITY FACTORS AND ASSUMPTIONS FOR ESTIMATING PROJECT AREA EMPLOYMENT

Employment Category	Density Factor/a/	Notes
Office	275 gsf occupied space per employee	A 5% vacancy is assumed. The employment density factor that includes this vacancy is 289.5 gsf total space per employee.
Service/Light Industrial/Research & Development (S/LI/RD)	Alternative A: 405 gsf occupied space per employee Alternative B: 465 gsf occupied space per employee	The variation in densities among Alternatives reflects different assumptions about the types of activities occupying the S/LI/RD space under each Alternative. Some Alternatives are assumed to have relatively more lower density business activities in S/LI/RD space than others. A 5% vacancy is assumed. Employment density factors including this vacancy are: - Alt. A: 426 gsf total space per employee. - Alt. B: 489 gsf total space per employee.
M-2 Industrial	410 gsf occupied space per employee	This designation applies only in Alternative N (No Project). The types of activities are assumed to be similar to those in the S/LI/RD category. A 5% vacancy is assumed. The employment density factor that includes this vacancy is 431.6 gsf total space per employee.
Retail	350 gsf per employee	This density factor reflects the mix of retail shops and restaurants and bars typical of retail space in office buildings and, generally, of retail development outside the primary retail district.
Hotel	.74 employees per room	Includes hotel management and housekeeping functions, as well as retail shops and restaurants and bars in hotels. This factor reflects the level of service of downtown hotels.

(continued)

TABLE XIV.A.2: DENSITY FACTORS AND ASSUMPTIONS FOR ESTIMATING PROJECT AREA EMPLOYMENT (continued)

Employment Category	Density Factor/a/	Notes
Community Facilities	777 gsf per employee	Community facilities building space estimated as follows: 80% building coverage, 1-1/2 story building.
Open Space	1 employee per 10 acres	Major open space land area only (not including open space associated with other uses). Accounts for gardening and landscape maintenance, not active recreation.
Port-Related/M-2	No standard density because of range of types of potential activities.	This designation applies in Alternatives A and N. In Alternative A, a small area east of Third Street would be used for back-land and storage for activities on piers; no employment would be directly associated with it. In Alternative N, the types of activities east of Third Street would be similar to those located there now. Non-maritime-related activities would be allowed, though generally these would be small-scale operations. Over time, there would be an increase in employment over current levels. Some existing facilities would continue to be used; there would also be some new construction.
Train Station	155 employees for existing CalTrain operation	Includes 87 employees associated with commuter rail operation and 68 employees with the maintenance facility. The maintenance facility is assumed to be relocated south of the Project Area in Alternatives A and B.
Pump Station	3 employees at existing facility	Three 8-hour shifts.
Building Maintenance/ Security	40 employees per 500,000 gsf	Applied to total of office, S/LI/RD, and retail space. Includes outdoor maintenance/landscaping.

(continued)

TABLE XIV.A.2: DENSITY FACTORS AND ASSUMPTIONS FOR ESTIMATING PROJECT AREA EMPLOYMENT (continued)

Employment Category	Density Factor/a/	Notes
Housing-Related	2 employees per 50 du	Accounts for management, security, and maintenance personnel.
Structured Parking	1 employee per 80 spaces	Parking spaces calculated as follows: 1 space/750-1,000 sq. ft. office and S/LI/RD space.
Existing Remaining	Not Applicable	An interim designation for the activities similar to those currently located within the Mission Bay Project Area that are assumed to continue to operate in certain locations there in 2000 given the development patterns of each Alternative.

du - dwelling unit

/a/ The density factors account for both full-time and part-time workers.

SOURCE: Recht Hausrath & Associates

Procedures for Estimating Project Area Population and Employed Residents

This section of the appendix presents factors for deriving estimates of Project Area population and employed residents for any amount of newly developed Project Area housing. There are a number of steps.

- Estimate households from housing units

  For all types of new housing, a 3.5% vacancy rate applied to the total number of units results in occupied housing units (or households).

- Estimate population from households

  Table XIV.A.3 and Table XIV.A.4 present persons-per-household factors for each type of Project Area housing (defined according to housing density) for 2000 and build-out/2020.

- Estimate population by age

  For each Alternative, the age distribution for the population in 2000 and at build-out/2020 is as follows:

Age	Percent of Total Population
Less than 15 years	16%
15-64 years	69%
65 years and over	15%
TOTAL	100%

- Estimate employed residents

  For each Alternative, the factors for estimating employed residents for 2000 and build-out/2020 are as follows:

Age	Percent of Total Population in Age Category That Would Be Employed
15-64 years	82%
65-74 years /a/	50%

/a/ Assume 50% of the population 65 years and over (see preceding item for estimating population by age) is 65-74 years of age.

TABLE XIV.A.3: PROJECT AREA HOUSEHOLDS AND POPULATION, BY HOUSING TYPE, BY ALTERNATIVE, 2000

Type of Housing	Alternative A			Alternative B			Alternative N		
	HH	Population	Persons/HH	HH	Population	Persons/HH	HH	Population	Persons/HH
Low Density	0	0	0	183	518	2.83	0	0	0
Over Retail	145	287	1.98	97	185	1.91	0	0	0
Medium Density	1,438	2,863	1.991	647	1,275	1.97	0	0	0
Medium-High Density	1,167	2,259	1.936	1,718	3,033	1.7654	0	0	0
High Density	0	0	0	0	0	0	0	0	0
TOTAL/a/	2,750	5,409	1.967	2,645	5,011	1.8945	0	0	0
Houseboats	20	36	1.8	20	36	1.8	20	36	1.8

NOTE: In order to make the conversions between households and population work out evenly, the persons-per-household factors have not been rounded. These factors are solely for the purposes of small-area analysis; the persons-per-household factors by type of housing can be used to estimate the population for any blocks or groups of blocks within the Project Area. Using these factors, small-area estimates of population will be consistent with the overall estimates for the Project Area.

HH - Household

/a/ The numbers presented on Table V.7, p. V.39, have been rounded. The total on that table includes the houseboats.

SOURCE: Recht Hausrath & Associates

TABLE XIV.A.4: PROJECT AREA HOUSEHOLDS AND POPULATION, BY HOUSING TYPE, BY ALTERNATIVE, BUILD-OUT/2020

Type of Housing	Alternative A			Alternative B			Alternative N		
	HH	Population	Persons/HH	HH	Population	Persons/HH	HH	Population	Persons/HH
Low Density	290	826	2.848	579	1,639	2.83	0	0	0
Over Retail	260	515	1.98	184	349	1.897	0	0	0
Medium Density	3,918	7,802	1.9913	4,651	9,166	1.9707	0	0	0
Medium-High Density	2,074	4,015	1.936	4,236	7,477	1.765	0	0	0
High Density	888	1,203	1.355	0	0	0	0	0	0
TOTAL/a/	7,430	14,361	1.9328	9,650	18,631	1.9307	0	0	0
Houseboats	20	36	1.8	20	36	1.8	20	36	1.8

NOTE: In order to make the conversions between households and population work out evenly, the persons-per-household factors have not been rounded. These factors are solely for the purposes of small-area analysis; the persons-per-household factors by type of housing can be used to estimate the population for any blocks or groups of blocks within the Project Area. Using these factors, small-area estimates of population will be consistent with the overall estimates for the Project Area.

HH - Household

/a/ The numbers presented on Table V.7, p. V.39, have been rounded. The totals on that table include the houseboats.

SOURCE: Recht Hausrath & Associates

APPENDIX B. LAND USE, BUSINESS ACTIVITY AND EMPLOYMENT

PROJECT AREA LAND USE AND EMPLOYMENT: DATA COLLECTION METHODOLOGY AND SUPPLEMENTAL TABLES

Introduction

This section of the appendix provides background on data collection for the Mission Bay Project Area as well as more detailed tables than those presented in the text to describe land use and employment in the Project Area.

Data Collection for the Mission Bay Project Area

Information on existing land use, business activity and employment in the Mission Bay Project Area was collected and summarized by Recht Hausrath & Associates (RHA). Records of the two major landowners--Santa Fe Pacific Realty Corporation and the Port of San Francisco--were the starting points for the data collection effort. Lease information and maps provided by both land-owners were sources for initial lists of businesses in the area and estimates of amounts of land and building space in various uses. To update and supplement that information, RHA undertook a complete inventory and survey of the Project Area in November and December 1985.

A sample survey was determined to be inadequate for the estimates and descriptive material needed for the EIR, so an effort was made to reach every business in the Project Area. The landlords' leasing information provided the initial contacts. Field work revealed businesses that were not on original tenant lists; as sub-tenants were identified, they were added to the inventory/survey. The Project Area also has business establishments that are not tenants of either Santa Fe Pacific or the Port; those businesses also were included in the inventory/survey.

The survey identified 121 establishments using space in the Project Area. Information on a total of 114 establishments was included in the final total for the business survey of establishments and employment. Three parking operations were not counted for enumerating establishments and employment because they had no employees based in the Project Area; the land area they use is counted in the land use tables as unattended parking. Another business represented in the Project Area only by an easement also was excluded from establishment totals. Three other establishments were not available for interview because they were moving (two into, and one out of, the Project Area).

Information on each business in the Project Area was gathered by means of an interview with a business representative, either on-site or at some other location, e.g., the business' headquarters. Both telephone and in-person interviews were conducted. In a few cases, the business representative completed a questionnaire used for the interviews and returned it by mail; often, the employer retained the more detailed part of the questionnaire on worker characteristics, completing and returning it later.

The questionnaire for the Project Area business interviews was modeled on similar instruments used in 1981 and 1982 by RHA in the C-3 District and South of Market/Folsom Employer Surveys done for the San Francisco Department of City Planning. The questionnaire was designed both to confirm information from other sources (lease records, maps, field observation) and to expand upon the description of the type and size of business operations in the Project Area. The questionnaire requested information in four general subject areas:

- current operations (type of business, functions of operations in the Project Area, amount of building space and land area used, use of rail service, relationship to maritime activities, other transportation needs);

- employment (number of workers in the Project Area, characteristics of the workers and of the jobs);

- background on locational choice; and

- future plans.

A copy of the questionnaire used in the Mission Bay Project Area Business Survey is on file at the Office of Environmental Review, Department of City Planning, 450 McAllister Street. The results of the survey are summarized in VI.B. Land Use, Business Activity, and Employment, pp. VI.B.1–VI.B.13, and in supplemental tables in this Appendix.

Description of Business Activities in the Mission Bay Project Area

The following list provides definitions and examples of business activity categories identified in the Mission Bay Project Area. RHA devised the groupings based on analysis of information from the survey of businesses in the Project Area. Each Project Area establishment was categorized in one of the groups, according to the primary function of the operations on-site. Tables and text summarizing survey results for establishments and employment use the categories to characterize activities in the Project Area. The asterisk identifies categories of businesses in which some or all establishments are maritime-related.

- Transportation and Related Services: trucking and other freight and passenger transportation functions, including associated warehousing, repair and maintenance, and dispatch services.

  - trucking, drayage and warehousing companies*;
  - passenger transportation services, including commuter rail, bus and shuttle bus operations;
  - moving and storage operations; and
  - repair, rental and maintenance services to the maritime freight and passenger transportation industries*.

- Wholesale/Distribution/Warehouse: wholesale sales, warehouse and delivery functions primarily for own account.

  - wholesale sales, distribution and warehousing for:
    - food and beverage products*;
    - electrical equipment and supplies*;
      furniture*;
    - paper products;
    - office products and supplies;
    - motor vehicles;
    - apparel and general merchandise;
    - miscellaneous consumer products*; and
    - construction materials*.

- Vehicle/Equipment Storage: storage functions only, including those of repair, sales, transportation, and other businesses.

  - motor vehicle storage (buses, trucks, autos);
  - wrecking yards;
  - salvage yards; and
  - equipment and materials storage for building and other contractors*.

- Manufacturing/Construction: on-site production or processing functions.

  - building materials processing;
  - manufacture of maritime and other industrial equipment and supplies*;
  - food processing (coffee)*; and
  - manufacture of displays and specialty fixtures.

- Office: administrative, management, clerical and professional functions.

- Retail/Restaurant: retail stores and eating and drinking establishments.

  - apparel manufacturer's sales outlet;
  - coffee shop, diner, drive-in, cafe; and
  - marine equipment and supplies*.

- Arts/Design: studios/workshops; there are no live-work studios in the Project Area.

  - fine artists;
  - custom printing/intaglio and graphic design workshops; and
  - custom apparel design.

- Other: miscellaneous functions that do not fit easily in other categories.

  - San Francisco Recreational Vehicle Park;
  - Vacant City Fire Station; and
  - Channel Street Pump Station.

Supplemental Tables

The following tables (Tables XIV.B.1-XIV.B.5) present detailed results of the Mission Bay Project Area inventory and business survey. For the supplemental tables, information on land use, establishments and employment is disaggregated according to location of the activity within the Project Area. There are three subareas: West of Third, East of Third and North of Channel (see Figure III.2, p. III.7). The columns labeled "Total" in each of the following tables present the information summarized in VI.B. Land Use, Business Activity, and Employment, pp. VI.B.1-VI.B.13.

ECONOMIC TRENDS IN THE BAY AREA REGION AND SAN FRANCISCO'S DOWNTOWN & VICINITY

Introduction

This section of the Appendix presents background tables and text in support of the discussion in VI.B. Land Use, Business Activity, and Employment pp. VI.B.22-VI.B.28, describing the trends behind the status of economic activity in San Francisco and the rest of the region in 1985. The supplemental data and discussion are useful background to understanding the future context for economic activity in the downtown, the rest of the City and the region.

TABLE XIV.B.1: MISSION BAY LAND AREA, BY USE AND LOCATION, 1985 (Acres)/a/

	Location							
	West of Third		East of Third		North of Channel		Total	
Use	Land Area	Percent of Total Land Area	Land Area	Percent of Total Land Area	Land Area	Percent of Total Land Area	Land Area	Percent of Total Land Area
Land Area in Use by Businesses/b/	44	32	35	54	12	24	91	36
Rail Use and Former Rail Yard/c/	32	23	19	29	20	39	71	28
Unattended General Purpose Parking Lots	2	1	--	--	4	8	6	2
Rest of Land Area/Vacant (Excludes Developed Streets)	60	44	11	17	15	29	86	34
Subtotal	138	100%	65	100%	51	100%	254	100%
Developed Streets							59	
China Basin Channel							12	
TOTAL							325	

/a/ Land area includes land with buildings.
/b/ Corresponds to estimates in Table XIV.B.2, p. XIV.B.5, of building space and land area used by businesses, with the exception of the commuter-rail facility, which is here classified as land in rail use. The land area estimates in this table (Table XIV.B.1) include open land area (land without buildings) used by businesses, plus land area on which the building space sits.
/c/ Includes both freight and commuter-rail yards. See note /b/, above. By 1987, much of the trackage devoted to rail freight use west of Third Street was removed, so there is less land area in rail use and more vacant land than indicated on the table.

SOURCE: Recht Hausrath & Associates

TABLE XIV.B.2: MISSION BAY BUILDING SPACE AND LAND AREA USED BY BUSINESS, BY BUSINESS ACTIVITY AND LOCATION, 1985 (Thousands of Gross Square Feet)/a/

	Location															
	West of Third				East of Third				North of Channel				Total			
Business Activity	Building Space	% of Total Building Space	Land Area	% of Total Land Area	Building Space	% of Total Building Space	Land Area	% of Total Land Area	Building Space	% of Total Building Space	Land Area	% of Total Land Area	Building Space	% of Total Building Space	Land Area	% of Total Land Area
Transportation & Related Services/b/	602	54.8	364	43.9	211	51.3	348	30.2	9	33.3	839	61.5	822	53.5	1,551	46.4
Wholesale/ Distribution/ Warehouse	379	34.6	86	10.4	56	13.6	15	1.3	--	--	--	--	435	28.3	101	3.0
Vehicle/Equipment Storage	73	6.7	340	91.0	--	--	332	28.8	--	--	225	16.5	73	4.8	897	26.8
Manufacturing/ Construction	--	--	--	--	86	20.9	289	25.1	--	--	--	--	86	5.6	2B9	8.6
Office	32	2.9	--	--	--	--	--	--	--	--	--	--	32	2.1	--	--
Retail/ Restaurant	5	0.5	39	4.7	45	11.0	149	12.9	1	3.7	--	--	51	3.3	188	5.6
Arts/Design	6	0.5	--	--	--	--	--	--	--	--	--	--	6	0.4	--	--
Other/c/	--	--	--	--	13	3.2	19	1.7	17	63.0	301	22.0	30	2.0	320	9.6
TOTAL	1,097	100.0%	829	150.0%	411	100.0%	1,152	100.0%	27	100.0%	1,365	100.0%	1,535	100.0%	3,346	100.0%
Percent of Total Building Space		71.5%				26.B%				1.7%				100.0%		
Percent of Total Land Area				24.8%				34.4%				40.8%				100.0%

/a/ Land area represents land, exclusive of buildings, that is used by businesses in the Project Area.
/b/ Includes land and some buildings used by the commuter-rail operation in the Project Area. (Excludes the rail freight yards, which are listed in Table XIV.B.1 in the rail-use category.)
/c/ Includes the City fire station facility (land and building), the San Francisco Recreational Vehicle Park and Channel Street Pump Station.

SOURCE: Recht Hausrath & Associates

TABLE XIV.B.3: MISSION BAY ESTABLISHMENTS AND EMPLOYMENT, BY BUSINESS ACTIVITY AND LOCATION, 1985/a/

	Location: West of Third				East of Third			
Business Activity	Establishments	Percent of Total Establishments	Employment	Percent of Total Employment	Establishments	Percent of Total Establishments	Employment	Percent of Total Employment
Transportation & Related Services/b/	23	27.7	581	51.2	7	28.0	170	25.9
Wholesale/ Distribution/ Warehouse	16	19.3	365	32.2	4	16.0	32	4.9
Vehicle/Equipment Storage	11	13.3	49	4.3	6	24.0	12	1.8
Manufacturing/ Construction	--	--	--	--	7	28.0	177	27.0
Office	22	26.5	106	9.4	--	--	--	--
Retail/Restaurant	4	4.8	25	2.2	1	4.0	265	40.4
Arts/Design	7	8.4	8	0.7	--	--	--	--
Other/c/	--	--	--	--	--	--	--	--
TOTAL	83	100.0%	1,134	100.0%	25	100.0%	656	100.0%
Percent of Total Establishments		72.8%				21.9%		
Percent of Total Employment				56.6%				32.7%

	North of Channel				Total			
Business Activity	Establishments	Percent of Total Establishments	Employment	Percent of Total Employment	Establishments	Percent of Total Establishments	Employment	Percent of Total Employment
Transportation & Related Services/b/	1	16.7	155	72.4	31	27.2	906	45.2
Wholesale/ Distribution/ Warehouse	--	--	--	--	20	17.5	397	19.8
Vehicle/Equipment Storage	2	33.3	40	18.7	19	16.7	101	5.1
Manufacturing/ Construction	--	--	--	--	7	6.1	177	8.8
Office	--	--	--	--	22	19.3	106	5.3
Retail/Restaurant	1	16.7	3	1.4	6	5.3	293	14.6
Arts/Design	--	--	--	--	7	6.1	8	0.4
Other/c/	2	33.3	16	7.5	2	1.8	16	0.8
TOTAL	6	100.0%	214	100.0%	114	100.0%	2,004	100.0%
Percent of Total Establishments		5.3%				100.0%		
Percent of Total Employment				10.7%				100.0%

/a/ The employment estimates cover all workers based in the area, including those who work elsewhere much of the time, such as truck drivers and sales people.
/b/ Includes the commuter-rail operations.
/c/ Includes the San Francisco Recreational Vehicle Park and Channel Street Pump Station.

SOURCE: Recht Hausrath & Associates

TABLE XIV.B.4: MISSION BAY RAIL FREIGHT USERS, BY BUSINESS ACTIVITY AND LOCATION, 1985/a/

	Location/b/					
	West of Third		East of Third		Total	
Business Activity	Establishments	Employment	Establishments	Employment	Establishments	Employment
Transportation & Related Services	6	305	--	--	6	305
Wholesale/Distribution/Warehouse	3	94	--	--	3	94
Vehicle/Equipment Storage	1	3	1	-- /c/	2	3
Manufacturing/Construction	--	--	2	40	2	40
Office	--	--	--	--	--	--
Retail/Restaurant	--	--	--	--	--	--
Arts/Design	--	--	--	--	--	--
Other	--	--	--	--	--	--
TOTAL	10	402	3	40	13	442

/a/ Rail freight use is defined to include only those establishments with facilities in the Project Area that ship or receive materials/goods by rail.
/b/ There are no rail freight users in the North of Channel subarea.
/c/ The facility in the Project Area is used for materials storage only. The major activity and employment for this establishment is located on the nearby piers.

SOURCE: Recht Hausrath & Associates

TABLE XIV.B.5: MISSION BAY MARITIME-RELATED ESTABLISHMENTS AND EMPLOYMENT, BY BUSINESS ACTIVITY AND LOCATION, 1985/a/

	Location/b/					
	West of Third		East of Third		Total	
Business Activity	Establishments	Employment	Establishments	Employment	Establishments	Employment
Transportation & Related Services	13	410	5	87	18	497
Wholesale/Distribution/Warehouse	3	13	2	19	5	32
Vehicle/Equipment Storage	2	3	2	--	4	3
Manufacturing/Construction	--	--	4	108	4	108
Office	8	39	--	--	8	39
Retail/Restaurant	--	--	--	--	--	--
Arts/Design	--	--	--	--	--	--
Other	--	--	--	--	--	--
TOTAL	26	465	13	214	39	679

/a/ Maritime-related establishments are those in which all or part of the activity involves working with or as part of the maritime industry. Those include: ship repair, ship maintenance/servicing, maritime equipment manufacturing and supply, cargo handling and storage, intermodal transport, and freight-forwarding and consolidation services.
/b/ There are no maritime-related establishments in the North of Channel subarea.

SOURCE: Recht Hausrath & Associates

San Francisco and the Rest of the Region

The California Employment Development Department (EDD) provides consistent employment data from 1972, updated annually. Analysis of the data for employment in the Bay Area illustrates the strength of employment growth in certain areas and the changing locational distribution of employment within the region. Table XIV.B.6 presents employment data for the nine-county region by Metropolitan Statistical Area (MSA) for 1972, 1981, and 1985. The MSA's are those defined by the U.S. Bureau of the Census. The nine-county Bay Area region is divided into five MSA's: Oakland (Alameda and Contra Costa Counties); San Francisco (Marin, San Francisco, and San Mateo Counties); San Jose (Santa Clara County); Santa Rosa-Petaluma (Sonoma County); and Vallejo-Fairfield-Napa (Napa and Solano Counties). The data series used in this discussion reflects the March 1985 benchmark.

Over the 13-year period (1972-1985), Bay Area employment grew by nearly one million jobs at an annual rate of more than 3% per year. The highest rates of employment growth over this period were in Santa Clara and Sonoma Counties (both more than 5% per year). Santa Clara County's evolution from a simple suburb to a world-renowned high-technology center occurred during this time period. Sonoma County's rapid rate of growth reflects a similar transformation, though not of the same scale. The rate of employment growth in the Vallejo-Fairfield-Napa MSA was somewhat higher than the regional average, also reflecting the emergence of suburban employment centers. Growth was slowest in urbanized areas with established employment centers. San Francisco shows the slowest growth rate in the region, about one-half the regional average. Marin, San Mateo, Alameda, and Contra Costa Counties also had relatively slower rates of growth.

There are two distinct patterns within the overall employment trend from 1972 through 1985: 1972-1981 and 1981-1985. While employment throughout the region grew at a fast pace between 1972 and 1981, all MSA's in the region except Santa Clara County show employment decline from 1981 to 1982, reflecting the consequences of the national economic recession. In all MSA's except San Francisco County, employment levels recovered and were higher by 1985 than in 1981.

The Oakland MSA (Alameda and Contra Costa Counties) is an exception to the pattern for the 1980s described above. The rate of employment growth was higher in those counties from 1981 through 1985 than it was from 1972-1981. The data illustrate the recent growth of employment in the East Bay suburbs, spurred by relocations from San Francisco.

San Francisco's Downtown & Vicinity - Changes in Economic Activity

During the 1970's through 1981, employment in the Downtown & Vicinity grew rapidly, faster than employment in the rest of the City. In the early 1980s, that trend was interrupted. Employment growth rates slowed and there were significant employment declines in some sectors so that employment was lower in 1985 than in 1981. Those changes in downtown economic activity are a large part of the explanation for the decline in total San Francisco employment from 1981 through 1985.

Table XIV.B.7 presents in detail changes in employment in the Downtown & Vicinity from 1981 through 1985 by business activity. Declines in office employment (a short-term pattern) as well as in services, distribution and manufacturing employment (a longer-term trend) were offset somewhat by growth in hotel, retail and other sales employment. (As noted in the EIR text, the decline for the office sector as a whole is the net result of even larger declines for some office activity, while other office activity continued to grow.)

TABLE XIV.B.6: BAY AREA EMPLOYMENT, 1972-1985

Area of Region/a/	Employment (Annual Average) 1972	1981	1985	Annual Rate of Change (Compounded) 1972-1985	1972-1981	1981-1985
San Francisco/b/	455,400	564,800	559,100	+1.59%	+2.42%	-0.25%
Rest of San Francisco MSA/c/ (Marin, San Mateo)	244,300	325,800	361,800	+3.07%	+3.25%	+2.65%
Oakland MSA (Alameda, Contra Costa)	558,300	691,400	767,800	+2.48%	+2.40%	+2.65%
Vallejo-Fairfield-Napa MSA (Napa, Solano)	75,300	107,100	118,600	+3.56%	+3.99%	+2.58%
Santa Rosa-Petaluma MSA (Sonoma)	60,700	100,100	118,200	+5.26%	+5.72%	+4.24%
San Jose MSA (Santa Clara)	412,900	695,600	793,400	+5.15%	+5.97%	+3.34%
TOTAL	1,806,900	2,484,800	2,718,900	+3.19%	+3.60%	+2.28%

NOTE: The employment data in the table are from a different EDD series than those in Table VI.B.11, p. VI.B.21. The employment data are annual averages for wage and salary employment (i.e., the self-employed are not included); the data in Table VI.B.11, p. VI.B.21, are for wage and salary employment in December. The only consistent time-series of employment data from EDD is annual average data for Metropolitan Statistical Areas (MSAs), not for counties. Notes /b/ and /c/ describe the adjustments made to include San Francisco employment.

/a/ The Metropolitan Statistical Areas (MSAs) are defined by the U.S. Bureau of the Census. There are five MSAs in the Bay Area: San Francisco MSA (Marin, San Francisco, and San Mateo Counties); Oakland MSA (Alameda and Contra Costa Counties); Vallejo-Fairfield-Napa MSA (Napa and Solano Counties); Santa Rosa-Petaluma MSA (Sonoma County); and San Jose MSA (Santa Clara County).

/b/ The average annual estimates for employment in San Francisco are based on EDD data to the extent they are available. RHA adjusted EDD December data when annual averages were not available on the county level. The 1972 estimate is from the EDD 1972-1980 annual average series for counties published annually in the EDD Annual Planning Information document. The 1981 estimate is preliminary data from an EDD series printed in April 1982 and since discontinued. The 1985 annual average estimate is RHA's estimate of annual average employment for San Francisco based on EDD's December 1985 data published in Annual Planning Information for San Francisco, May 1986. None of the estimates includes the self-employed.

/c/ The estimates for the rest of the San Francisco MSA are derived by subtracting the estimates for San Francisco from the annual average totals for the MSA (Marin, San Francisco, and San Mateo Counties).

SOURCE: California Employment Development Department, Annual Average Wage and Salary Employment for Metropolitan Statistical Areas, March 1985; and Recht Hausrath & Associates

TABLE XIV.B.7: EMPLOYMENT IN THE DOWNTOWN & VICINITY, BY BUSINESS ACTIVITY, 1981 AND 1985

Business Activity	1981	1985	Change
Office	256,100	249,740	-6,360
Retail	26,610	28,910	+2,300
Hotel	10,850	12,240	+1,390
Sales/Showroom	4,380	4,550	+170
Cultural/Institutional/Educational	11,070	10,970	-100
Services	7,990	7,500	-490
Distribution	4,940	4,590	-350
Manufacturing	7,920	6,890	-1,030
Building Maintenance/Security	6,450	6,450	--
Construction	8,090	7,890	-200
Subtotal	344,400	339,730	-4,670
Mission Bay	1,680	2,000	+320
TOTAL DOWNTOWN & VICINITY	346,080	341,730	-4,350
TOTAL CITY	589,300	584,900	-4,400

NOTE: The 1981 estimate of total City employment is that developed for the Downtown Plan EIR. The 1985 estimate is an update developed for the Mission Bay EIR. Both are based on California Employment Development Department (EDD) data. The estimates include the self-employed and therefore differ from those in Table XIV.B.6, p. XIV.B.10. In addition, the change in total City employment shown in the table differs from the change indicated by the EDD data. Part of the change implied in the EDD data reflects adjustments for coding errors and definitions. RHA's analysis attempted to separate those changes from real changes in employment.

SOURCE: Recht Hausrath & Associates

Table XIV.B.8 presents the 1981-1985 change in employment in the Downtown & Vicinity by subarea. The pattern is not the same for all geographic areas. Employment declined in the C-3 District and South of Market areas and increased in the Northeast Waterfront and Civic Center / South Van Ness areas. The changes in the C-3 District and South of Market subareas reflect the large declines in office employment during the period as well as on-going losses of manufacturing, distribution and some services employment. Some of the office employment lost from the C-3 District represented a gain for more outlying office locations in the Northeast Waterfront, Civic Center / South Van Ness and South of Market subareas as businesses sought office space at a lower cost than that available in the Financial District. Increased economic activity in those areas in the early 1980s was attributable primarily to growth in office and retail sectors. The South of Market subarea experienced something of every pattern. Some South of Market back-office activity relocated outside San Francisco while other office activities seeking relatively low-cost

TABLE XIV.B.8: EMPLOYMENT IN THE DOWNTOWN & VICINITY, BY SUBAREA, 1981 AND 1985

Subarea	1981	1985	Change
C-3 District	267,590	261,980	-5,610
South of Market	30,340	28,280	-2,060
Northeast Waterfront	26,470	27,450	+980
Civic Center / South Van Ness	20,000	22,020	+2,020
Subtotal	344,400	339,730	-4,670
Mission Bay	1,680	2,000	+320
TOTAL	346,080	341,730	-4,350

SOURCE: Recht Hausrath & Associates

space expanded in the area. There were increases in retail, entertainment and showroom employment while employment in older industrial and wholesaling businesses declined in part as a consequence of development pressures for conversion of existing space for relatively higher-rent-paying uses.

LAND USE AND EMPLOYMENT ANALYSIS

Introduction

This section of the appendix presents background information related to the cumulative land use, business activity and employment analyses and forecasts used in the EIR. As described in Chapter IV. Study Approach and Organization, p. IV.3, the EIR analyzes Mission Bay Alternatives in a future context that incorporates other growth and change over time. The cumulative perspective takes in other City and regional growth, focusing specifically on San Francisco's Downtown & Vicinity of which Mission Bay would be a part.

Where appropriate and relevant, the EIR analyses used forecasts prepared by others. Examples are Association of Bay Area Governments (ABAG) forecasts of employment and population through 2000 for the rest of the region outside San Francisco, and California Department of Finance (DOF) forecasts of population through 2020. Forecasts for the Downtown & Vicinity and the total City were prepared specifically for the Mission Bay EIR, however, to be sensitive to differences between Alternatives. The longer-term (2020) employment scenarios for the Downtown & Vicinity, the City, and the rest of the region also were prepared specifically for the EIR, since other available forecasts do not extend that far into the future.

The methodology for the economic analyses and forecasts done for the Mission Bay EIR is consistent with and builds upon economic analyses and forecasts prepared for the Downtown Plan EIR (EE81.3, certified October 18, 1984). In that regard, the work for the Mission Bay EIR updates, expands the scope, and otherwise improves the analysis of the Downtown Plan EIR. As in the case of the Downtown Plan EIR, extensive economic

analysis and forecasting work was undertaken specifically for the Mission Bay EIR, to address the complicated questions posed by Mission Bay's large-scale long-term development and to provide the necessary long-term future context for the cumulative impact assessment. Special inventories and analyses provided information for the Downtown & Vicinity for the setting year, since employment and land use data are not regularly published for subareas of the City. The economic forecasts were prepared to be sensitive to the subject of the analysis: the Mission Bay Alternatives and their associated downtown and citywide contexts for growth and change.

This section of the Appendix describes methodology and data sources for establishing 1985 setting conditions for land use, business activity and employment for the cumulative analyses as well as methodology and data sources for the economic forecasts. Background tables to supplement summary discussion in the EIR text are provided, and special issues related to the mechanics and assumptions of the economic analysis are discussed.

Estimating Space and Employment in the Downtown & Vicinity for 1985

Methodology

For the Mission Bay EIR, the area called "Downtown & Vicinity" is defined to include: the C-3 District (the area analyzed in the Downtown Plan EIR; it is larger than the areas designated "C-3" in the Planning Code), South of Market (including Showplace Square, Rincon Hill, and South Beach, as well as most of the area covered by the South of Market Plan), Northeast Waterfront (including Golden Gateway, Jackson Square and the Ferry Building), Civic Center / South Van Ness, and the Mission Bay Project Area. (See Figure IV.1, p. IV.5, for a map of the Downtown & Vicinity and its subareas.) There is no annual source for land use or employment data for that part of the City. Consequently, analysis of citywide employment data (that are available), survey data, land use inventories, and information on recent land use changes resulting from new development provided the basis for the 1985 description of space by use and employment by business activity in the Downtown & Vicinity.

San Francisco employment data updated and published annually by the California Employment Development Department (EDD) set parameters for estimating employment for the Downtown & Vicinity, an area that accounts for the majority of San Francisco employment. Land use inventories provided estimates of amounts of space in the Downtown & Vicinity and of how that space was used. Business surveys provided more detailed information on space use, in particular, the critical factor of employment density (gross square feet of space per employee) for various types of activities.

Estimates of occupied space by use, vacant space and total building space were derived from land use inventories and lists of major development projects. For estimates for the Downtown & Vicinity in this EIR, earlier inventories for the C-3 District and South of Market were updated and new inventories undertaken to cover the rest of the study area. In 1981 and 1982, the Department of City Planning conducted land use inventories in the C-3 District and South of Market./1/ Rather than re-do the complete inventories to establish conditions in 1985, the original inventories were updated using Department of City Planning information on development projects (office, retail and hotel) completed and available for occupancy at the end of 1985 that were not accounted for in the 1981/1982 data. The updates of space by use incorporated additions due to new construction and conversions as well as space lost as a result of demolition or conversion. The 1985 estimates of space by use for the C-3 District and the South of Market areas are incorporated in the estimates for the Downtown & Vicinity (excluding Mission Bay) presented in VI.B. Land Use, Business Activity, and Employment, p. VI.B.13. For other

parts of the Downtown & Vicinity (Northeast Waterfront, Civic Center / South Van Ness and Mission Bay) land use inventories were conducted in 1985 to establish existing space use conditions for those areas. (The first section of this appendix, pp. XIV.B.1-XIV.B.8, describes the data collection effort for the Mission Bay Project Area and presents more detailed tables of the results than are presented in the EIR text, see VI.B. pp. VI.B.1-VI.B.12.) The results of the Northeast Waterfront and Civic Center/South Van Ness inventories are incorporated in the estimates for the Downtown & Vicinity presented in the setting section, see pp. VI.B.13-VI.B.15.

Employment estimates by business activity for the Downtown & Vicinity in 1985 were derived through a multi-step procedure. Employment estimates for 1981 for the C-3 District and 1982 for South of Market had been prepared for earlier studies. Those estimates were based on a procedure whereby employment density factors (from survey data gathered in 1981 in the C-3 District and 1982 in the South of Market Area) for detailed business activities [disaggregated by Standard Industrial Classification (SIC)] /2/ were applied to land use inventory estimates of space by use. The results were estimates of employment by business activity and SIC for large subareas of the Downtown & Vicinity. The calculated employment estimates were evaluated against citywide totals published by EDD to assess the reasonableness of the estimates. Some adjustments to the calculated estimates were required to bring them more in line with total employment data./3/

The 1981/1982 estimates for the C-3 District and South of Market subareas of the Downtown & Vicinity had to be updated to 1985 for the Mission Bay EIR. The approach for updating was to consider the Downtown & Vicinity as a whole for both years (1981 and 1985) and evaluate changes in employment, using EDD citywide data and other information as guidelines. To consider the Downtown & Vicinity as a whole required estimates for the Northeast Waterfront and Civic Center / South Van Ness subareas, as well as for the Mission Bay Project Area.

Employment estimates by business activity and SIC for <u>1985</u> for the subareas needed to complete the picture for the Downtown & Vicinity were derived from land use inventories and survey data. The estimate for the Mission Bay Project Area is the result of the business survey conducted there in 1985 (see pp. XIV.B.1-XIV.B.3). For the other subareas, the estimating procedure was similar to that used for the C-3 District and South of Market areas. In fact, employment density factors for detailed business activities developed from the employer/employee surveys conducted in 1981/1982 in those areas were used in the Northeast Waterfront and Civic Center / South Van Ness areas. Density factors from the earlier surveys that would be appropriate for types of business activities in the additional areas were selected to be applied to land use inventory estimates of space in various categories. In the Northeast Waterfront and Civic Center / South Van Ness areas, since no employer/employee surveys were planned, data collection for the land use inventory was fairly detailed, allowing, for example, for sub-categories of office space, and distinctions between industrial, warehouse and repair space. Thus, even without the benefit of business surveys in those areas, the employment estimates are sensitive to the mix of uses and characteristics of the variety of business activities and SIC groups in each.

The 1985 estimates for Northeast Waterfront, Civic Center / South Van Ness and Mission Bay were adjusted back in time to 1981 estimates so that totals for the Downtown & Vicinity for 1981 could be compared to citywide data. That analysis considered trends in economic activity, development patterns, changes in land use, and how those subareas fit in the scheme of documented citywide and downtown changes over the period. The resultant order-of-magnitude estimates for 1981 for the additional subareas were added to the C-3 District and South of Market estimates to establish totals for employment in the Downtown & Vicinity by business activity and SIC in 1981.

The procedure for updating 1981 estimates to 1985 for the Downtown & Vicinity involved consideration of a variety of factors: changes in employment in each sector, changes in space use, and changes in vacancy. EDD's citywide employment data by SIC for 1981 and 1985 provided a starting point for analyzing employment changes. Conversations with EDD staff provided more background on changes evident in the data. Analysis centered on the extent to which changes in each sector occurred in the Downtown & Vicinity or in the rest of the City. It also accounted for the fact that net change for the City shown in EDD data could represent larger declines in some areas offset by growth in other areas. Review of documented "move-outs"/4/ and corporate decisions and performance affecting the level of employment in downtown businesses during the 1981-1985 time period was an important part of the procedure. In addition, information on changes in the use of space through new construction, conversion and demolition was incorporated along with vacancy rate data and information on the net absorption of space.

The resultant estimates of employment in the Downtown & Vicinity for 1985 were evaluated in several ways. The distribution of total employment among subareas of the Downtown & Vicinity was reviewed for reasonableness. The distribution of employment by business activity among those subareas was another check on the estimates. Did the distribution reflect what was known about patterns of downtown economic activity from land use inventories and other observations? Estimates of employment in the Downtown & Vicinity by SIC were compared to citywide employment data by SIC to assess the reasonableness of the percentage of the total assigned to the downtown area.

Sources for 1985 Estimates for the Downtown & Vicinity

The 1985 estimates of space and employment in the Downtown & Vicinity were derived from a variety of sources including citywide data, land use inventories, business surveys, and other relevant information describing recent economic conditions. At the time the analysis was done, the most recent data available were for the year 1985. Some sources are for earlier years. Most sources providing quantitative data do not measure conditions specifically for the Downtown & Vicinity (e.g., most employment information is published as citywide data). Therefore, a variety of indirect sources were reviewed and compared to document the most recent conditions and trends. The following list specifies the major sources of data and information for estimating space use and employment by business activity.

Space.

- C-3 District Land Use Inventory, 1981, as updated to 1984
- South of Market Land Use Inventory, 1982
- Northeast Waterfront Land Use Inventory, 1985
- Civic Center / South Van Ness Land Use Inventory, 1985
- San Francisco Department of City Planning, Major Projects Completed in 1985, December 31, 1985; Major Projects Completed in 1986, November 4, 1986; Major Projects Under Construction, November 4, 1986
- Mission Bay Project Area Land Use Inventory, 1985
- Coldwell Banker, Office Vacancy Index of the United States, September 30, 1982 and quarterly reports from March 1985 through December 1986

- Cushman and Wakefield, San Francisco Market Research Department, Quarterly Update, January 15, 1986

- Fuller Commercial Brokerage, "San Francisco Office Leasing Market Report," November 1, 1985

- Gallelli Real Estate, "Office Space Survey for the Downtown Financial District, San Francisco, California," June 1985

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Employment.

- California Employment Development Department, Annual Planning Information: San Francisco City and County, 1986-1987, May 1986, (includes citywide wage and salary employment for December 1985 and forecasts for 1986 and 1987)

- Downtown Plan EIR, 1984

- South of Market Rezoning Study, 1985

- C-3 District Employer/Employee Surveys, 1981/82

- South of Market/Folsom Employer/Employee Surveys, 1982

- Mission Bay Project Area Business Survey, 1985

- U.S. Department of Commerce, Bureau of the Census, County Business Patterns: California, 1982 and 1983

- U.S. Department of Commerce, Bureau of the Census, Census of Service Industries: California, 1977 and 1982

- U.S. Department of Commerce, Bureau of the Census, Census of Retail Trade, Major Retail Centers: California, 1977 and 1982

- Association of Bay Area Governments, Projections '85, by census tract for San Francisco

- Pacific Properties Group, "Corporate Relocations from San Francisco in the 1980's," June 1985

- Information on company relocations/job losses for San Francisco supplied by Economic Development Department, San Francisco Chamber of Commerce

- Articles and reports related to the local and regional real estate market, business location decisions, tourism, general economic trends and conditions and the health of individual industries important to San Francisco

Economic Forecasting Approach and Methodology

Overview

The cumulative context for future employment and space use for the Mission Bay EIR was developed according to an economic forecasting approach. The forecasts provide a complete and consistent future context for both employment and building development. The approach follows a demand-based perspective; i.e., economic growth results in expansion of employment; additional employment results in demand for additional space; that demand absorbs available space and stimulates additions to the supply of space through new construction or conversion/renovation of existing buildings. In addition, employment declines in some sectors, leaving space vacant for absorption, conversion or demolition. Some of the decline is attributable to increased demand for space from other sectors; the rest of the decline occurs for other reasons.

The forecasting methodology for the Mission Bay EIR is essentially the same as that for the Downtown Plan EIR. The Mission Bay EIR required consideration of additional geographic areas as well as a longer time-frame (to incorporate build-out of the Mission Bay Alternatives). Consequently, the geographic scope of the forecasting effort was expanded from the C-3 District used in the Downtown Plan EIR to include the larger area referred to as the "Downtown & Vicinity" and to deal more specifically with the rest of the City and citywide totals. The economic outlook for the forecasts was updated to reflect changes in economic conditions since 1981. The time-frame for the forecasts was extended beyond 2000 to provide the cumulative context for build-out of the Project Area. That necessitated consideration of longer-term economic and demographic trends and factors affecting labor force and employment growth in general.

The forecast approach uses analysis of current economic conditions and past trends, and assessments of the outlook for economic growth and the supply of space in the future. The forecasts are long term, setting employment and space use parameters for the cumulative context for future growth and change in addition to Mission Bay. They reflect reasonably foreseeable future conditions from the vantage point of the mid-1980s. Natural disasters, other catastrophes or economic shocks cannot be accounted for.

Growth in the Mission Bay Project Area is part of the cumulative scenario analyzed in the EIR. There are consequently three different sets of forecasts (one for each Alternative) that reflect differences in the Project Area as well as different cumulative scenarios depending on the Alternative for Mission Bay. Since the same underlying outlook for population, demographics and the economy in the future applies for all Alternatives, different forecasts for each Alternative provide a means of evaluating how the choice of a development program for Mission Bay would affect the future scenario for downtown, the City, and the rest of the region, assuming all other conditions were the same.

The forecasts for 2000 represent about 15 years of growth from 1985 and the forecasts for build-out/2020 about an additional 20 years of growth thereafter. The years per se are approximate benchmarks appropriate for use in long-term forecasting. For example, should the recessionary phase of a business cycle be in evidence in 2000, then the 2000 forecasts could actually occur a few years later. Similarly, if an expansionary phase were in full swing, the forecast level of economic activity could occur a few years earlier.

Such variation in the timing of growth would not affect conclusions of the cumulative analysis. Business cycles that affect the timing of downtown and citywide growth also are likely to affect growth in Mission Bay. Thus, the timing of Project Area and cumulative growth would remain consistent. Further, only an approximate time frame is relevant for evaluating impacts of future citywide and regional growth with regard to service capacities, transportation and other infrastructure, and housing supply. It is not necessary to identify the precise year when impacts of cumulative growth would first be in evidence. Growth and the infrastructure to accommodate it are never "in sync" on an annual basis. Consequently, it is reasonable to conduct cumulative analysis for future benchmark years, recognizing that some variation in timing is possible.

As described in Chapter IV. Study Approach and Organization, pp. IV.7-IV.9, there are distinctions between the forecasts through 2000 and the longer-term forecasts through build-out/2020. The latter are more speculative, and the estimates presented in the EIR more uncertain than the forecasts for 2000. Using the same basic economic framework, the approach for the longer-term forecasts was somewhat different than the approach for the 2000 forecasts. With fewer other forecasts to rely on, with analysis of trends for business activity becoming less relevant that far into the future, with other conditions such as zoning and planning policy difficult to predict that far into the future, the forecasts for build-out/2020 were developed to represent one possible scenario that could be supported as reasonable for the purposes of the Mission Bay EIR. The forecasts are less detailed than those for 2000. The approach and the methodology focused on total employment and the allocation of employment growth to the Downtown & Vicinity, the rest of the City and the rest of the region.

For both 2000 and build-out/2020, the forecasts for subareas of the Downtown & Vicinity are not all of equal weight in terms of the analysis behind the results. There is more analysis of development patterns and economic trends for the C-3 District, South of Market and Mission Bay subareas than there is for the Northeast Waterfront and Civic Center / South Van Ness subareas. The C-3 District and South of Market forecasts had the benefit of previous work done for planning purposes in those areas. Development in the Mission Bay Project Area is the subject of this EIR, so likely future economic activity there received special attention. In the other two areas, background work for the forecasts was oriented towards providing order-of-magnitude estimates for cumulative analysis in this EIR. The forecasts consequently are less detailed than would be necessary for specific planning purposes in those areas.

Downtown & Vicinity and Total City Forecasts, 2000

Explanation of Methodology and Assumptions. The economic forecasting methodology for the year 2000 cumulative forecasts combined both demand and supply perspectives. Analysis of the following demand and supply factors provided the basis for many of the forecast conclusions:

- past trends in employment by SIC for the City and the region (not available by business activity);

- other employment forecasts by SIC for the City, the region and the nation;

- business and industry organization trends and market forces;

- recent history and future outlook for sectors of the economy particularly important in downtown San Francisco (e.g., banking, trade, tourism, utilities, government, corporate headquarters, corporate and other business services, and entrepreneurial activity);

- location preferences of various business functions, including consideration of types of space, rents, labor availability, and transportation access;

- location and amounts of development potential in the Downtown & Vicinity and (to a lesser extent) in the rest of the City, including consideration of existing vacant space, space in projects approved and under construction, development proposals, and rezoning efforts;

- location options elsewhere in the region; and

- interdependence of economic activities (e.g., office and retail, tourism and retail, corporate office and business supply and services, retail/restaurant and distribution).

Analysis of those factors was worked into a forecasting procedure that considered the Downtown & Vicinity, its subareas (including the Project Area), and the total City as a unit, but also separately, with potentials in each area influencing the overall forecast as well as the locational allocation.

The forecasting procedure began with analysis at a citywide level, considering the outlook for total employment and overall economic activity as well as the outlook for various economic sectors. At that level, historic rates of growth and recent trends were analyzed. Particular attention was given to establishing the background and reasons for recent trends to determine how future patterns might be similar or different. Factors of importance for future economic growth in the City were identified, focusing on San Francisco's ability to compete with the rest of the Bay Area region as well as other locations. Other forecasts and descriptions of the future economic outlook for various business sectors were reviewed, including those for the City, the region, the state, and the nation. All of those analyses were synthesized in consideration of the mix of business activities in the Downtown & Vicinity and in the rest of the City and identification of those activities likely to grow, those likely to remain relatively stable and those likely to decline over time. The results of the first level of the forecasting procedure were preliminary forecasts of employment by business activity/SIC for San Francisco.

The second level of the forecasting procedure involved allocation of those preliminary forecasts to the Downtown & Vicinity and the rest of the City, with explicit consideration of the Mission Bay Project Area and other subareas of the Downtown & Vicinity. The analysis at that level focused on the availability of space of various types in various locations. The allocation involved shifts between subareas for some activities, declines in occupied space for some activities, and absorption of existing vacant as well as newly constructed space. The results of the second level of the forecasting procedure were preliminary forecasts of employment by business activity/SIC for subareas of the Downtown & Vicinity and the rest of the City, and forecasts of space use for subareas of the Downtown & Vicinity.

Assumptions about projects approved but not yet built as well as about land use policy, zoning and other City requirements affecting future commercial development are important parts of the economic forecasting analysis. For the Mission Bay EIR, the policies, zoning and requirements in place or being implemented at the time the analysis was done (late 1985 through 1986) were those assumed to remain in place in the future. Such assumptions provide the basic framework for establishing development potential and parameters for amounts and types of space in various locations. With Proposition M, they also guide the pace of future development.

The plans and zoning assumed for the forecasts for the Downtown & Vicinity are listed below:

- Downtown Plan
- South of Market Plan (implemented as interim controls through April 1988)
- Rincon Hill Plan
- Existing M-1 and M-2 zoning for parts of South of Market not covered by South of Market Plan, Rincon Hill Plan or Redevelopment Agency projects
- North of Market Mixed Use District
- Mid-Market Plan
- Chinatown Plan
- Existing zoning in Northeast Waterfront (C-2, P and RC-4, including Jackson Square Historic District and Northeast Waterfront Historic District)
- Existing zoning in Civic Center / South Van Ness (P, C-2, CM, RM-1, NC-3, and Hayes-Gough NCD) and rezoning as proposed in Van Ness Avenue Plan
- Redevelopment Agency Projects (Golden Gateway, Yerba Buena Center, Rincon Point-South Beach)

Differences between the land use programs of the Alternatives were critical factors at this stage of the forecasting analysis. The different amounts of commercial space in the Project Area under each Alternative determined the amount and type of employment accommodated there, as well as the likely pace of development. Thus, analysis of the Alternatives was key to determining the allocation of business activity and employment growth and the degree of land use change in other parts of the Downtown & Vicinity and the rest of the City.

The process of allocating the citywide forecasts of employment by business activity to Mission Bay and other subareas of the Downtown & Vicinity for each Alternative suggested some revisions to the preliminary forecasts. The citywide estimates were adjusted as necessary to conform to each Alternative. The forecasts for the rest of the City also were refined at that point. The magnitudes of growth or decline were evaluated in light of expected development projects outside the Downtown & Vicinity, the on-going pattern of decline for some industries, move-outs or other shifts in location, and the relationship between economic activity in the Downtown & Vicinity (particularly in the Project Area) and in areas nearby. The result was a set of three forecasts, one for each Alternative, covering the Project Area, other subareas of the Downtown & Vicinity, and the rest of the City.

In the final step of the forecasting procedure, all aspects were evaluated together: the overall business activity/SIC scenarios, the share of employment growth and total employment allocated to the Downtown & Vicinity and the rest of the City, the business activity scenarios for the Downtown & Vicinity, and the development patterns for the Downtown & Vicinity illustrated by the scenarios for changes in occupied and vacant space. The resultant final forecasts were reviewed in this way for consistency and

reasonableness. The final scenarios for each Alternative were compared to determine if the logic of the different Mission Bay land use programs was carried through to the cumulative forecasts.

Key economic conclusions about the future outlook for business activities in the Downtown & Vicinity and the rest of the City that resulted from the forecasting analysis are presented below and summarized in VI.B. Land Use, Business Activity, and Employment, pp. VI.B.56-VI.B.57 and VI.B.65-VI.B.67). The points outlined also could be considered the assumptions behind the forecasts. If the scenarios predicted for the various business activities turn out differently or the relationships identified do not hold up over time, then the forecasts could be different. Nevertheless, the outlook described as the future context is the result of substantial background analysis and appears reasonable at this time for use in the Mission Bay EIR.

- Expanded business and professional services (legal, accounting, advertising, consulting, mailing and publishing, personnel supply and training, computer and data/information services, communications-related services, and design and graphic arts) represent the greatest growth potential for office activity. Changes in office technology and operations and increasing demand for specialized services support that growth. San Francisco will remain a regional legal and business service center supporting federal, state and local court systems located in San Francisco, corporate and other business activities in the City and throughout Northern California, and the international market within the Pacific Basin.

  That type of office activity includes a diverse group of firms, in both size and function. Many value the accessibility to other businesses, and the image and ease of communication offered by a central San Francisco location. Others, particularly smaller firms, are more sensitive to costs of space. They will seek more peripheral locations in the Downtown & Vicinity and in older industrial areas, often space in older buildings. The latter group includes many start-up businesses, as well as those in design and other creative sectors.

- San Francisco is forecast to remain a major financial center. Banking, savings and loans and other credit operations, security and commodity brokers, and real estate activities are expected to grow. Growth of housing and population throughout Northern California, income growth, and growth of business activity will support those office sectors.

  Most growth is expected in smaller firms and in regional divisions of larger companies. Many of those firms will seek central locations that provide image, good accessibility and ease of face-to-face communication.

- Executive and managerial office functions of large finance, insurance, manufacturing, mining, and similar companies will grow and will continue to prefer locations in the downtown core. Despite the slippage of the early 1980s, San Francisco continues to be an important headquarters city and should remain so in years ahead. National and international corporations doing business in the western United States will continue to look to San Francisco and Los Angeles as locations for their operations, and sometimes to both cities. Although administrative and back-office functions of larger corporations have decentralized (as discussed below), central-office operations have remained in the City and continue to value the image and ease of communication offered by downtown San Francisco locations.

- The future outlook for back-office activity in San Francisco is mixed. Relocation of administrative and back-office functions of large companies from the center city to the suburbs occurred in the early 1980s. Such large shifts of employment out of San Francisco are not expected in the future. Generally, however, growth of that part of the office sector will be slower than in the past. Back-office operations of mid-size companies and smaller divisions of large firms will be the types that continue to locate in San Francisco. For many larger back-office operations, the attraction of suburban locations will continue to remain strong.

  Some growth of back-office activities is expected in the Downtown & Vicinity. Given the cost-consciousness and special needs for larger floor areas of some in that group, demand for space will focus on peripheral locations.

- Government office activities are unlikely to grow significantly in the Downtown & Vicinity. Federal and state government office employment in leased space in central locations will decline as leases expire. There will be shifts in the locations of government employment as agencies will seek to reduce their space costs or locate in peripheral locations such as south of Market Street or in the Civic Center/South Van Ness area. In addition, some growth of local government activities in the Civic Center area is expected.

- The administrative functions of manufacturers' sales representatives, wholesalers and import/export companies will support office growth and activity in the merchandise/apparel marts. Growth of retailing downtown and the attractiveness of San Francisco to foreign firms will be responsible for growth of those activities.

- Retail growth will be supported by spending of tourists and conventioneers, people working in the Downtown & Vicinity, residents of the area, and other residents of the City and region. Growth is forecast in specialty retailing, restaurants, entertainment, and convenience retail supported by residents and workers. Growth in the Union Square area is expected to enhance its specialty market orientation. Other retail growth is expected to occur near arts/entertainment activities in Civic Center and new housing added south of Market, as well as in more peripheral locations near areas of office activity.

- Tourism and conventions offer important growth opportunities for the Downtown & Vicinity. Rising incomes, increased leisure time, and the City's reputation as a desirable destination will continue to support growth. Further, expansion of Moscone Center will enhance the City's ability to attract conventions. Tourism supports growth of overnight accommodations, restaurant and retail establishments, entertainment, the arts, other recreation-related activities, as well as distribution and service businesses providing products and supplies to those related activities. A large share of the activities supported by tourism are in the Downtown & Vicinity and will continue to be centered there.

- Sales/showroom activities in Showplace Square will continue to serve as San Francisco's center for sales to the trade in furniture, home furnishings, interior design, and gifts. The identity of the area will become stronger over time and the range of wholesale sectors represented will expand.

- Relatively small growth is expected for cultural, institutional and educational activities. Some growth is expected in educational facilities such as those offering adult education courses (computer training, accounting, management skills, secretarial training, etc.). Growth also is forecast for cultural and arts activities including the performing arts and museums.

- Services include a mix of activities with different trends for the future. Services to buildings, communications/messenger/parcel-delivery services and other support services will remain in the Downtown & Vicinity with some growth expected. Most growth of employment will include building maintenance/security personnel, many of whom work on-site in office buildings and retail stores throughout the Downtown & Vicinity. Over time, services supporting businesses in the downtown core will concentrate in more outlying portions of the Downtown & Vicinity where costs are relatively low.

  Other service activities such as repair and rental services that do not serve customers in the downtown core primarily will find lower-cost locations outside of the Downtown & Vicinity. Auto repair services and other large space users such as transportation and freight and warehousing services located south of Market will have lower cost and more convenient location options elsewhere and will continue to leave the Downtown & Vicinity.

- Distribution activities remaining in the Downtown & Vicinity include large-space users who located in the South of Market area many years ago. The ongoing pattern of decline in those activities is expected to continue. The South of Market area no longer has strong advantages of convenient access to transportation and major market areas and there are lower-cost, more convenient location options elsewhere. There are often other uses willing to pay higher rents for the closer-in locations.

  For smaller sales and distribution activities providing products to businesses in the downtown core (e.g. office machines and furniture, paper products, restaurant equipment and supplies), outlying parts of the Downtown & Vicinity will continue to provide convenient and cost-effective locations. That contributes to slower rates of employment decline in the overall distribution group than would otherwise be the case.

- Employment in manufacturing activities is expected to continue to decline over time. The remaining representatives of producers who located south of Market many years ago, including those in food and metal and electrical products industries, will continue to leave the area. Many of those still left are in old outmoded facilities. Other more specialized operations and those placing value on proximity to other activities located in the Downtown & Vicinity are expected to remain in the area and to grow in some cases. Production facilities and studios related to printing and film and video industries are forecast to grow in the South of Market area. Similarly, art workshops, studios and custom workshops associated with the wholesale design and furnishings industry also are expected to increase, although larger operations of those types are expected to locate further to the south, outside the Downtown & Vicinity.

- Construction activity in the Downtown & Vicinity will continue to support a large number of person-years of construction labor. On an average annual basis, however, construction employment is expected to decline in the future

primarily because the amount of office building development will decline from recent levels. Construction activity will be supported by new development, conversions, ongoing upgrading, and expansion of infrastructure.

Comparison to Forecasts in the Downtown Plan EIR. Employment forecasts for the C-3 District subarea of the Downtown & Vicinity prepared for the Mission Bay EIR are different from the C-3 District employment forecasts prepared for the Downtown Plan EIR (see Table XIV.B.9). Although the geographic boundaries are the same, the employment forecast through 2000 is lower in the Mission Bay EIR than the Downtown Plan EIR forecast, reflecting updated economic analysis of recent trends in employment and growth potential for downtown business sectors.

As described in VI.B. p. VI.B.59, the difference between the two forecasts in C-3 District employment in 2000 is about 45,000 (the difference between 376,420 [Downtown Plan Alternative in the Downtown Plan EIR] and 331,160/331,530 [Alternative A / Alternatives B and N in the Mission Bay EIR]). That difference represents about 12% fewer jobs in the C-3 District through 2000 according to the revised forecasts.

Comparing the forecasts in terms of employment growth is complicated by differences in C-3 District employment estimates for the base years (1981 and 1984/1985). As described above, economic analysis of the Mission Bay EIR included preparing employment estimates for a 1985 setting. The Mission Bay EIR estimate of C-3 District employment in 1985 reflects that recent analysis; the Downtown Plan EIR estimate of employment in 1984 does not.

The Downtown Plan EIR estimates were prepared when the most recent citywide employment data available (from EDD) were for 1981. A land use inventory, an extensive employer/employee survey, interviews, and other data analyses were conducted in 1981 and 1982 to establish an estimate of C-3 District employment and space use in 1981. Most Downtown Plan EIR setting text and tables describing C-3 District land use, space use and employment are for 1981./5/

The year 1984 was designated the official "setting" for the Downtown Plan EIR analysis, because new Downtown Plan policies would go into effect in that year. Therefore, 1984 estimates for C-3 District space and employment were required. For 1984 estimates of space, the 1981 land use inventory was updated to account for new construction, demolition and conversion due to projects under construction in mid-1982. The 1984 employment estimates presented in the Downtown Plan EIR are simple extrapolations of forecasted C-3 District growth from 1981 through 2000. The EIR acknowledged that the employment estimate was likely to be high, given uncertainty about the effects of the recession in the early 1980s and the difficulty of making short-term predictions from a study with a longer-term perspective./6/

Analyses for the Mission Bay EIR, incorporating citywide employment data from EDD for 1984 and 1985 as well as other evidence of recent changes in the level of employment downtown, indicate that the short-term C-3 District employment growth from 1981 to 1984 projected for the Downtown Plan EIR did not occur. In fact, employment declined from 1981 to 1985 (see pp. VI.B.23-VI.B.24).

The 1981 estimate of C-3 District employment by business activity is essentially unchanged as a result of recent analyses of downtown employment. Review of updated EDD employment data for the City for 1981 led to a downward adjustment in employment in the hotel sector. That is reflected in the revised 1981 estimate presented in Table XIV.B.9 and elsewhere in this Appendix (see Table XIV.B.7, p. XIV.B.11, and Table XIV.B.8, p. XIV.B.12).

TABLE XIV.B.9: COMPARISON OF C-3 DISTRICT EMPLOYMENT ESTIMATES FROM THE DOWNTOWN PLAN EIR AND THE MISSION BAY EIR

Downtown Plan EIR		Mission Bay EIR	
Year	Estimate	Year	Estimate
1981	270,370 (derived from published data)	1981	267,590 /a/ (derived from published data and revised since Downtown Plan EIR per adjustments made by EDD)
1984	286,130 (estimated from simple extrapolation of 1981-2000 forecast)	1985	261,980 /b/ (derived from published data)
2000	376,420 (forecast)	2000	331,160 (Alt. A) - 331,530 /c/ (Alts. B&N) (forecast)
Years	Change	Years	Change
1981-2000	+106,050	1981-2000	+63,570 (Alt. A) - +63,940 (Alts. B&N)
1981-1984	+15,760	1981-1985	-5,610
1984-2000	+90,290	1985-2000	+69,180 (Alt. A) - +69,550 (Alts. B&N)

NOTE: The estimates in the table include both permanent employment and annual average construction employment.

/a/ See Table XIV.B.8, p. XIV.B.12.
/b/ See Table VI.B.8, p. VI.B.17.
/c/ See Table VI.B.19, p. VI.B.58.

SOURCE: Recht Hausrath & Associates

Thus, the 1985 C-3 District estimates presented in the Mission Bay EIR follow from the 1981 estimates in the Downtown Plan EIR. The 1985 estimates for the Mission Bay EIR represent a more realistic assessment of conditions in the C-3 District in the mid-1980s than do the 1984 projections in the Downtown Plan EIR.

The preceding discussion highlights the difficulty in comparing the employment growth represented by the forecasts: the growth anticipated for the early 1980s in the Downtown Plan EIR did not occur [see the line item on the table for "Change 1981-1984" (which was a projection) vs. "Change 1981-1985" (which is based on published data for that period)]. Consequently, comparing the Downtown Plan EIR change from 1984 through 2000 (+90,000) to the Mission Bay EIR change from 1985 through 2000 (+69,000) is inappropriate and understates the real difference between the forecasts. [The one-year discrepancy (between 1984 and 1985) for that comparison is not important, since employment did not change much from 1984 to 1985.] Comparing the two forecasts of change in employment from 1981 through 2000 is appropriate, since the base year estimates for both forecasts are essentially the same and are derived from published data. For that time period, the Downtown Plan EIR forecast shows growth of about 106,000 jobs in the C-3 District while the updated forecasts for the Mission Bay EIR show growth of about 64,000 jobs. The difference--42,000 jobs--(or 45,000 if the adjusted 1981 estimate is used as the starting point for both forecasts) is about 40% less employment growth for the C-3 District in the Mission Bay EIR compared to the Downtown Plan EIR.

That difference between the two C-3 District forecasts is due to revised estimates for office employment. Much of the actual employment decline from 1981 though 1985 was attributable to conditions in the office sector: decentralization of some activities to the suburbs, mergers and acquisitions, deregulation, and other factors affecting the health and performance of specific industries and firms. While some of those factors were anticipated in the Downtown Plan EIR forecasts, others were not. Analyses for the Mission Bay EIR indicated it was unlikely that the Downtown Plan EIR forecast would be achieved by the year 2000 given the extent of employment decline in certain office sectors, the range of factors affecting employment in the early 1980s and the duration of the effects. To achieve the Downtown Plan EIR forecast would require more employment growth from 1986 through 2000 than was originally forecast for the entire period from 1981 through 2000. Moreover, the resultant rate of employment growth from 1986 through 2000 (2.45% per year, compounded) would be higher than the rate that prevailed during the strong growth years of the 1970s (2.42% per year, compounded, from 1972-1981, see Table XIV.B.6, p. XIV.B.10). Analysis for this EIR including review of other forecasts indicated that such a future trend was highly unlikely. Consequently, the C-3 District forecast was revised to reflect recent economic conditions and an updated outlook on the future.

The updated forecasts also reflect changes to land use policies and zoning since the Downtown Plan EIR forecasts were prepared. In general, more recent policies limit the potential for office development in some areas compared to what was assumed originally. The Downtown Plan as approved incorporated lower floor-area ratios, lower height limits and restrictions on the ability to shift transferable development rights between subareas of the C-3 District compared to provisions of the Plan as proposed and assumed for forecasting purposes for the EIR. Subsequent plans and rezoning for mid-Market Street, North of Market, Chinatown and parts of South of Market also reduced the amount of office development allowed in areas included within the boundaries of the C-3 District used for the Downtown Plan EIR forecasts. In addition, a development fee for child care was adopted and Proposition M was approved. (See p. XIV.B.37 for more detailed discussion of Proposition M and the forecasts for the Mission Bay EIR.) The updated C-3 District forecast in this EIR accounts for those policy changes affecting development potential.

Comparison to Other Forecasts. Background analysis for the Mission Bay EIR cumulative forecasts included review of other employment forecasts for San Francisco. There are several sources for those forecasts, and the projections available at the time the EIR analysis was underway covered a broad range in terms of expected future employment growth (see Table XIV.B.10). In the table, the forecasts are ordered from lowest growth to highest growth. The forecasts for the Mission Bay EIR fall in the middle of the range, with a higher rate of growth than some forecasts and a lower rate of growth than others.

The employment forecasts for San Francisco in this EIR are higher than forecasts prepared by the Association of Bay Area Governments (ABAG). ABAG's most recent forecast (Projections '87) for San Francisco is closer to the Mission Bay EIR scenarios than the forecast in Projections '85. Where Projections '85 had shown growth from 1980 to 1985 of about 14,000 jobs, Projections '87 was updated to reflect recent conditions showing San Francisco employment remaining relatively constant over that period. Also, total employment in 2000 has been revised upward for the most recent projections. Although the revised ABAG forecast of employment growth in San Francisco is more similar to the Mission Bay EIR forecasts, some difference still remains. The difference is in the office sector, primarily in the outlook for growth of employment in business and professional services and finance, insurance and real estate activities. The outlook for other sectors is similar. Within San Francisco, the difference is concentrated in the Downtown & Vicinity. The ABAG and EIR forecasts of growth in the rest of the City are more similar./7/

Forecasts for the total City by Wells Fargo Bank and Institute for the Future also show lower rates of growth than those for the Mission Bay EIR. The annual rates of growth for the three lower forecasts (using the updated forecast in Projections '87 as the low end) range from 1.06% to 1.16%, as compared to 1.4% for the citywide forecast in this EIR.

The U.S. Department of Commerce Bureau of Economic Analysis employment forecasts for San Francisco, San Mateo and Marin counties show an annual rate of growth of 1.5%. Since San Francisco is likely to have a lower growth rate than the other two counties, the growth rate for the City's employment in that forecast may be similar to that for the Mission Bay EIR forecast.

Forecasts prepared by Pacific Gas and Electric Company (PG&E) and the National Planning Association expect higher rates of employment growth in San Francisco than anticipated in the forecast prepared for this EIR. Those two higher forecasts reflect annual rates of growth of 1.53% and 1.71%, respectively.

The economic analysis and forecasting for the Mission Bay EIR included a more in-depth look at different sectors and subsectors of San Francisco's economy than did analyses for most of the other forecasts. Unlike the others, the Mission Bay EIR economic analysis directly incorporated local land use policies and real estate market conditions along with economic growth potentials in the numerous submarkets for business activities and functions having different preferences for locations and types of space. It also is the only analysis that focuses on forecasts for the Downtown & Vicinity.

Evaluated against other forecasts, the forecasts prepared for this EIR were judged to be reasonable based on currently available information and to be appropriate for use in Mission Bay cumulative impact assessment. Given uncertainties regarding future conditions, it was concluded that the Mission Bay EIR forecasts would be more likely to be high than low; it seems more likely that the economy might grow more slowly than anticipated; growth rates actually might be more similar to those at the lower end of the range presented in the table. Consequently, the EIR analysis takes a conservative approach for analyzing cumulative effects of future growth.

TABLE XIV.B.10: COMPARISON OF SAN FRANCISCO EMPLOYMENT FORECASTS, 1986-2000

Source for Forecast	Amount of Growth	Annual Growth Rate	Comments
ABAG/a/	+75,900	+0.84%	The lower ABAG forecast in Projections '85 was replaced by the higher forecast in Projections '87
ABAG/b/	+95,200	+1.06%	
Wells Fargo Bank/c/	+98,000	+1.07%	
Institute for the Future/d/	+106,950	+1.16%	
Mission Bay EIR	+134,400-136,700	+1.39-1.41%	Range reflects Mission Bay Alternatives
Bureau of Economic Analysis/e/	NA	+1.50%	1983-2000 for San Francisco, San Mateo and Marin Counties combined
PG&E/f/	+172,400	+1.53%	
National Planning Association/g/	+188,350	+1.71%	
Past per EDD/h/	+103,700	+1.59%	1972-1985

NA - Not applicable.

NOTE: The forecasts listed above were done for different purposes and involved different types of analysis and different levels of specificity about San Francisco's economy. They can be compared generally in terms of the outlook for the future that each provides.

/a/ Association of Bay Area Governments, Projections '85, July 1985.
/b/ Association of Bay Area Governments, Projections '87, July 1987.
/c/ Wells Fargo Bank, "San Francisco - Its Economic Future," June 1987.
/d/ San Francisco Department of City Planning, "Jobs/Housing Relationship, Mission Bay, San Francisco," and "Economic Base/Employment Opportunities, Mission Bay, San Francisco" Special Study for Mission Bay, prepared by Institute for the Future, September 1986.
/e/ U.S. Department of Commerce, Bureau of Economic Analysis, 1985 OBERS BEA Regional Projections, Vol. 2, Metropolitan Statistical Area Projections.
/f/ Pacific Gas and Electric Co. (PG&E), "Service Area Economic and Demographic Forecast Reports, Golden Gate Region," March 1987.
/g/ National Planning Association, Regional Economics Projections Series, 1986.
/h/ See Table XIV.B.6, p. XIV.B.10.

SOURCE: Recht Hausrath & Associates

Forecasts for the Rest of the Region, 2000

Mission Bay EIR cumulative analyses at the regional level are based on forecasts of employment and population growth in counties outside San Francisco prepared by the Association of Bay Area Governments (ABAG). At the time the EIR analyses were done (1986 and early 1987), the forecasts in Projections '85 were the most recent ABAG forecasts available. The employment projections for the rest of the region from Projections '85 are presented in Table VI.B.23, p. VI.B.70.

The ABAG projections are the best source for estimates of future regional growth through 2000. They are based on analysis of economic and demographic factors affecting regional growth and on development potential throughout the region. The approach is essentially "demand-driven" in that overall regional employment forecasts are derived from analysis of economic factors and trends. The analysis considers national economic growth conditions and the relative competitiveness of the region's economy. It also considers population and demographic trends related to the supply of labor supporting regional economic growth. Regional employment growth is allocated to subregional areas based on consideration of local economies and information about development potential derived from land supply estimates and local plans and policies. In general, land supply is not a constraint to growth in the region. However, local land use decisions affect development potential in specific areas and, potentially, affect the allocation of growth depending on how demand for land compares to supply.

The basic logic and methodology for the ABAG projections are sound. The overall rates of regional economic growth are reasonable given recent economic conditions and trends, and the allocation of growth to various parts of the region outside of San Francisco makes sense in light of recent and likely future patterns of economic growth and development throughout the region. Thus, it is reasonable to use the ABAG projections in the Mission Bay EIR as the general background context for cumulative growth in the rest of the region. There was no need to develop forecasts for the rest of the region in the same way that forecasts were prepared for San Francisco since the Alternatives evaluated in this EIR do not affect growth in the rest of the region directly. Further, other factors besides those specific to San Francisco and to Mission Bay are more important to growth and development in other parts of the region.

The EIR cumulative analysis benefited from availability of the ABAG projections for the rest of the region. It would not be possible to undertake for one project what is accomplished by ongoing efforts of a regional agency with responsibility for developing regional forecasts. Moreover, the cumulative transportation analysis relies on complicated regional projections prepared by the Metropolitan Transportation Commission (MTC) based on Projections '85 (see Appendix E. Transportation, p. XIV.E.26).

Using ABAG Projections '85 forecasts for the rest of the region outside San Francisco raises a question about the difference between the Projections '85 forecast for San Francisco and the Mission Bay EIR forecast for San Francisco. Projections '85 shows less employment growth in San Francisco than does the Mission Bay EIR. The higher Mission Bay EIR forecasts might reflect more total employment in the region than projected by ABAG. Some of the difference might reflect differences in outlook for the allocation of growth in the region, not total regional employment: in the Mission Bay EIR forecast growth occurs in San Francisco, while, in the ABAG forecast, that growth is presumed to occur in suburban counties. It is difficult to predict adjustments necessary to compensate for each type of difference. Moreover, differences affecting locations would be distributed among a number of potential areas in the rest of the region. At that point,

also, the amount of employment involved probably would not make a difference to conclusions of EIR cumulative analyses. Thus, for this EIR, employment in the rest of the region was not adjusted downwards to compensate for higher levels of employment in San Francisco. The result is that more total employment in the region is analyzed in the cumulative impact assessment than if adjustments had been made. Moreover, the additional growth is concentrated in San Francisco, providing a conservative approach for analysis of impacts in the City and impacts on systems serving the City.

Since the EIR analyses were done, ABAG completed Projections '87 to update economic projections for the region. Employment growth in the rest of the region is higher by 8,200 in Projections '87 than in Projections '85 (growth of 812,700 jobs compared to 804,500). This difference represents a small increase in growth (about 1%). The relatively small change indicates that basic trends reflected in Projections '85 have not changed substantially and still are applicable. ABAG also increased the projected growth for San Francisco, although the revised projection for 1985-2000 is lower (by about 40,000 jobs) than the Mission Bay EIR forecast for San Francisco. Total regional employment growth assumed for the cumulative analyses in the EIR (Mission Bay EIR forecast for San Francisco and ABAG Projections '85 for the rest of the region) still remains higher than employment growth for the total region in Projections '87.

The total regional employment scenario for 2000 (including San Francisco and the rest of the region) was evaluated in light of forecasts of regional labor force in 2000. As with employment in 2000, ABAG's Projections '85 provided estimates of labor force in 2000 for the rest of the region while, for San Francisco, analysis for this EIR provided the estimates. Evaluation of the employment forecasts focused on the match between jobs and labor force throughout the region to ensure that future labor supply was adequate to support projected job growth. The analysis considered the location of the labor supply relative to San Francisco jobs and jobs in the rest of the region as well as the extent of regional in-commuting and out-commuting. (See VI.C. Housing and Population, p. VI.C.52, for discussion of the future relationship between employment and employed population [labor force] at the regional level.)

Methodology for Longer-Term Forecasts, Build-out/2020

Rationale and Purposes for Longer-Term Scenarios. The Mission Bay EIR required scenarios of growth in addition to that occurring in the Project Area that would go beyond the forecast horizon commonly used today: 2000 or 2005. That is because the large amount of development in the Project Area (under the Alternatives analyzed here) would not be fully occupied until some time beyond the year 2000. Analyzing the amount of commercial and residential development in each Alternative in the context of other potential development and the pace of employment and population growth to absorb additional space indicated that full occupancy would occur approximately 30 years from initial absorption of space at Mission Bay. If that began around 1990, then the year 2020 would be an appropriate benchmark for the forecast horizon beyond 2000. Consequently, scenarios of employment and population growth from 2000 through 2020 were developed for the Downtown & Vicinity, the rest of the City, and the rest of the region to provide the cumulative context for full build-out of the Mission Bay Alternatives for this EIR.

The build-out/2020 scenarios were developed solely for the purposes of the Mission Bay EIR: to provide parameters for cumulative impact assessment of longer-term growth that could occur over the Mission Bay build-out period and to provide a background context against which to compare the Alternatives when fully developed and occupied. The scenarios are based on generalized conclusions about future economic and real estate

market conditions and remaining development potential. Those conclusions come from review of other forecasts and analysis of economic activity, land use and development patterns necessary to complete the cumulative forecasts through 2000. The land use policies and zoning assumed for the forecasts through the year 2000 are assumed to continue in effect through the build-out period for Mission Bay.

As mentioned in the overview describing the forecast approach (see p. XIV.B.17), the scenarios for the 2001-2020 period are less detailed than those for the preceding period (through 2000), although they are consistent with economic trends and development patterns illustrated in the forecasts through 2000. Economic forecasting becomes more uncertain and speculative 30 years into the future. The build-out/2020 scenarios presented in the EIR should be interpreted as order-of-magnitude estimates. They represent one possible outcome for the longer-term future, based on trends established through the year 2000 and a general concept about how those trends will play themselves out over the years beyond 2000.

<u>Scenarios for San Francisco Employment and Employment in the Downtown & Vicinity.</u> There are three scenarios for employment in the Downtown & Vicinity and the total City through build-out/2020 in the EIR--one for each Alternative. The scenarios reflect not only differences in amount and type of employment in the Project Area, but also differences in the associated cumulative context resulting from the Alternatives for Mission Bay.

The central component of the longer-term forecasting procedure was establishing parameters for total employment in the City and in the Downtown & Vicinity, including Mission Bay, as well as for office employment in the Downtown & Vicinity. The procedure was iterative, for each Alternative. Preliminary growth rates for total City employment and total employment in the Downtown & Vicinity were selected to reflect continued future growth but a somewhat slower pace of growth after 2000. Employment totals and growth for the Downtown & Vicinity through 2020 were evaluated as percentages of citywide totals and growth. Total employment and total employment growth, as well as total office employment and office employment growth in the Project Area were evaluated as percentages of Downtown & Vicinity and San Francisco totals and growth 2001-2020. Evaluations such as those led to refinements of the forecast amounts and growth rates to reflect expected patterns of employment growth and decline in the City, the Downtown & Vicinity and the rest of the City.

Although much of the forecasting analysis for the cumulative build-out/2020 scenarios focused on evaluating overall growth rates for total employment and office employment, and allocating that growth to different parts of the City, more detailed assessment was required to develop cumulative scenarios that would complement each Alternative for Project Area development. The goal was cumulative scenarios that illustrated differences in economic activity implied by the choice between Alternatives.

Since Project Area employment varies more between Alternatives at build-out than at the interim analysis year (2000), the cumulative scenarios for build-out/2020 had to account for where employment growth would occur for Alternatives that would not accommodate that demand in Mission Bay. That part of the procedure for developing the cumulative scenarios to accompany build-out of the Mission Bay Alternatives consequently had to address explicitly the question of location options for business activities of various types. The conclusions of that analysis are reflected in the resultant final scenarios and are described in the impact assessment in terms of implications for Nearby Areas and for citywide and regional development patterns.

Analysis of differences between Alternatives in Mission Bay commercial space and employment, and consideration (for each land use/business activity) of location options in Nearby Areas, elsewhere in the City or elsewhere in the region that would substitute for a Mission Bay location, provided the basis for finalizing the cumulative scenarios for build-out/2020. On the basis of that more detailed evaluation, estimates of growth for total employment and office employment and preliminary allocations of that growth to the Downtown & Vicinity and the rest of the City were revised.

The business activity and location option analysis for the build-out/2020 scenarios included consideration of subareas of the Downtown & Vicinity and the dynamics of downtown development. The final scenarios for each Alternative incorporate increased development in peripheral areas where it is allowed under current zoning as more central areas reach their full development potential as prescribed by current zoning. The scenarios also reflect declines in older existing businesses (primarily industrial, warehouse and distribution activities). The extent of decline depends somewhat on the magnitude of growth of activity expected in the area. That varies between Alternatives. New construction, conversion and demolition were factored into the analysis. Evaluating changes in building space provided background for conclusions about pressures on existing activities and potential declines in employment for those businesses. Proposition M also was considered (see discussion below on p. XIV.B.41).

The detailed business activity and location analysis was necessary to illustrate differences between Alternatives: the results should be interpreted as patterns, not as precise forecasts. The purpose of the order-of-magnitude cumulative scenarios is to enable comparisons between the patterns associated with the Alternatives.

Scenarios for Space by Use in the Downtown & Vicinity. Although the primary purpose of the longer-term forecasting analysis was to develop estimates of employment growth through build-out/2020 (since employment is the relevant factor for most cumulative impact assessment), estimates of space by use in the Downtown & Vicinity also were developed. The scenarios of space by use incorporate development in the Project Area as well as other new development to accommodate future employment growth and maintain an overall average office vacancy rate of about 5%. The scenario for office space conforms to the limits established in Proposition M as interpreted for the Mission Bay EIR (see p. XIV.B.41 for more discussion). The scenarios of changes in space by use account for declines in occupied space of certain types as businesses leave the area. In the procedure used to develop the estimates, some of that space is assumed to be demolished for new construction, some to be converted to other uses, and some to remain vacant pending future development.

The scenarios for space by use for each Alternative were developed by applying employment density factors to the scenarios for employment by business activity. Office vacancy assumptions were required, as were assumptions about the share of development accounted for by conversions and the amount of space demolished as a consequence of new construction. While the procedure was technically precise and detailed, the resultant estimates are approximations. The patterns illustrated by the scenarios are more reliable and important to the analysis than the estimates themselves.

Tables XIV.B.11 and XIV.B.12 present the scenarios of space by use for all analysis years, including the change in space 2001-2020. The first table presents the Alternative scenarios for the entire Downtown & Vicinity including Mission Bay. The second table presents the Alternative scenarios for the Downtown & Vicinity, excluding Mission Bay. The tables supplement the Future Context discussion in VI.B. Land Use, Business Activity, and Employment, p. VI.B.71.

TABLE XIV.B.11: SPACE IN THE DOWNTOWN & VICINITY BY USE, 1985, 2000 AND BUILD-OUT/2020 (Thousands of Gross Square Feet)

Use	1985	Scenario for Alternative A 2000	Scenario for Alternative A 2020	Scenario for Alternative A 2001–2020	Scenario for Alternative B 2000	Scenario for Alternative B 2020	Scenario for Alternative B 2001–2020	Scenario for Alternative N 2000	Scenario for Alternative N 2020	Scenario for Alternative N 2001–2020
Occupied Space										
Office/a/	68,963	94,884	108,500	+13,616	94,459	106,600	+12,141	94,459	106,600	+12,141
Retail	10,259	12,351	13,500	+1,149	12,341	13,500	+1,159	12,366	13,400	+1,034
Hotel	10,732	14,571	16,700	+2,129	14,571	16,700	+2,129	14,571	16,700	+2,129
Other Space/b/	35,443	32,502	31,400	-1,102	31,464	28,500	-2,964	32,661	33,600	+939
Subtotal	125,397	154,308	170,100	+15,792	152,835	165,300	+12,465	154,057	170,300	+16,243
Vacant Space/c/	17,266	11,233	11,000	-233	11,152	10,800	-352	11,179	11,000	-179
TOTAL SPACE	142,663	165,541	181,100	+15,559	163,987	176,100	+12,113	165,236	181,300	+16,064

NOTE: The estimates above include Mission Bay and other subareas of the Downtown & Vicinity. Table V.5, p. V.34, presents more detail for Mission Bay space by use by Alternative. The estimates are for building space and exclude the small amount of land area, exclusive of buildings, that is used by businesses. The estimates include space that is occupied or available for occupancy; space under construction is not included.

/a/ Office space includes space occupied by office uses. Other uses (such as retail) in office buildings are categorized separately. Space occupied by government office activities is included in the office category.

/b/ The "other space" category includes manufacturing, warehouse, services, distribution, showroom, institutional, parking, and S/LI/RD uses. The numbers for "other space" are the net result of the changes in space use for all of these activities.

/c/ Most "vacant space" in 1985 was office space. Vacant space includes more than space that was vacant and available for lease. For 1985, the estimate includes office space vacated by move-outs or consolidations that was not on the market and may have been temporarily occupied at lower employment densities, but which could eventually accommodate employment growth. Vacant space also includes other space formerly occupied by warehouse or industrial activities, for example, that was being held vacant prior to conversion or demolition. The forecast assumes that much of this vacant space is absorbed, primarily due to office employment growth, over the 1986–2000 period. The estimates of vacant space in 2000 and 2020 incorporate a 5% vacancy for total office space and a small amount of additional space (vacated due to declines in other uses) that would not yet have been put to a new use.

SOURCE: Recht Hausrath & Associates

TABLE XIV.B.12: SPACE IN THE DOWNTOWN & VICINITY EXCLUDING MISSION BAY, BY USE, 1985, 2000 AND BUILD-OUT/2020 (Thousands of Gross Square Feet)

Use	1985	Scenario for Alternative A 2000	Scenario for Alternative A 2020	Scenario for Alternative A 2001-2020	Scenario for Alternative B 2000	Scenario for Alternative B 2020	Scenario for Alternative B 2001-2020	Scenario for Alternative N 2000	Scenario for Alternative N 2020	Scenario for Alternative N 2001-2020
Occupied Space										
Office/a/	68,931	93,509	104,600	+11,091	Same as A	105,700	+12,191	Same as A	105,700	+12,191
Retail	10,208	12,256	13,200	+944	Same as A	13,200	+944	Same as A	13,200	+944
Hotel	10,732	14,171	16,300	+2,129	14,571	16,700	+2,129	14,571	16,700	+2,129
Other Space/b/	34,004	30,784	27,900	-2,884	30,784	27,800	-2,984	Same as A	27,800	-2,984
Subtotal	123,875	150,720	162,000	+11,280	151,120	163,400	+12,280	151,120	163,400	+12,280
Vacant Space/c/	17,253	11,102	10,600	-502	Same as A	10,700	-402	Same as A	10,700	-402
TOTAL SPACE	141,128	161,822	172,600	+10,778	162,222	174,100	+11,878	162,222	174,100	+11,878

NOTE: The estimates above are of building space. They include space that is occupied or available for occupancy; space under construction is not included.

/a/ Office space includes space occupied by office uses. Other uses (such as retail) in office buildings are categorized separately Space occupied by government office activities is included in the office category.

/b/ The "other space" category includes manufacturing, warehouse, services, distribution, showroom, institutional, and parking uses. The numbers for "other space" are the net result of the changes in space use for all of these activities.

/c/ Most "vacant space" in 1985 was office space. Vacant space includes more than space that was vacant and available for lease. For 1985, the estimate includes office space vacated by move-outs or consolidations that was not on the market and may have been temporarily occupied at lower employment densities, but which could eventually accommodate employment growth. Vacant space also includes other space formerly occupied by warehouse or industrial activities, for example, that was being held vacant prior to conversion or demolition. The forecast assumes that much of this vacant space is absorbed, primarily due to office employment growth, over the 1986-2000 period. The estimates of vacant space in 2000 and 2020 incorporate a 5% vacancy for total office space and a small amount of additional space (vacated due to declines in other uses) that would not yet have been put to a new use.

SOURCE: Recht Hausrath & Associates

Scenarios for the Bay Area Region. The build-out/2020 analysis required a scenario of employment for the rest of the Bay Area region. The ABAG forecasts used for the year 2000 analysis do not extend that far into the future. The few employment forecasts that do extend beyond 2000/2005 are useful as background sources but either do not extend to the 2020 forecast horizon or do not provide estimates for the Bay Area counties./8/

The first step in developing a regional employment scenario for 2020 was to review what other forecasts implied about longer-term economic growth in the region. Growth rates for employment beyond 2000 from ABAG's Projections '85 and Projections '87, National Planning Association projections and Bureau of Economic Analysis (BEA) projections were compared. The pattern of longer-term growth among corridors of the region (San Francisco, East Bay, South Bay, North Bay) illustrated by those projections also was analyzed.

A preliminary employment scenario for 2020 for this EIR was derived by applying growth rates reflecting judgments about the likely longer-term continuation of future patterns of economic activity throughout the region to total employment estimates for 2000. The judgment involved answering such questions as: would the rate of employment growth in peripheral counties (e.g., Contra Costa, Solano, Sonoma) continue to be higher than the average for the rest of the region through 2020? As in analysis for the Downtown & Vicinity and citywide cumulative scenarios for build-out/2020, employment growth and totals in the preliminary scenarios for each corridor were evaluated as percentages of regional totals and growth. The scenario for future San Francisco growth also was considered and incorporated at this stage of the regional analysis. The employment estimates for 2020 were adjusted until the overall pattern of future economic activity and how that pattern appeared to be changing over time made sense as an order-of-magnitude scenario for use in cumulative analysis.

Since the size of the labor force is a critical determinant of employment, and longer-term demographic trends related to the age of distribution of the population are influential factors in shaping economic activity, estimates of the labor force in 2020, based on California Department of Finance (DOF) population projections through 2020 and assumptions about labor force participation, were used to evaluate estimates of employment for 2020. The DOF projects population for each county by age and sex through 2020. An estimate of the labor force in 2020 was derived from those projections using assumptions about the ages through which people would be in the labor force and likely future age-specific labor force participation rates./9/

The overall demographic pattern by 2020 results in a tight labor market and slowing rates of employment growth. Most of the baby boom will be over 60 years of age and the number of people in their prime working years will be relatively small (the "baby bust"). Consequently, labor force participation rates are expected to continue to be high and people will be encouraged to continue working past ages 60-65. (The opposite trend toward early retirement now in effect reflects the same demographic pattern--the baby boom followed by the baby bust--at the earlier stage of its influence. The baby boom is now in the prime working years, putting pressure on the preceding generation now nearing retirement age to leave the labor force early, freeing up opportunities for younger people.)

Evaluating the match between labor force and employment in 2020 involved developing estimates for the region as a whole, separating estimates for San Francisco (related to the more detailed cumulative analysis described above) from estimates for the rest of the region as as unit. The estimates were derived through an iterative process that considered the inter-relationship of many factors: overall rates of population and

employment growth, demographic patterns, housing market factors, characteristics of the population, and the extent of regional in-commuting and out-commuting. Preliminary estimates were evaluated in light of what they implied about how relationships between those factors would change over time. Adjustments continued until a scenario resulted that appeared reasonable and supportable. (See VI.C. Housing and Population, p. VI.C.52, for discussion of the future relationship between employment and employed population [labor force] at the regional level.)

Sources for Scenarios for the Downtown & Vicinity, Total City and Rest of Region for 2000 and Build-out/2020

The economic forecasting analysis drew on other forecasts and on synthesis of various pieces of economic information. Some of the information applied to specific conditions in San Francisco and the Bay Area. Other data and information reflected more universal conditions and trends. The following list identifies the key sources used in the forecasting analysis. The list includes projections prepared by others that were either consulted or used directly (as appropriate) in developing cumulative growth scenarios for the Mission Bay EIR, as well as supporting documentation and information used to identify historic patterns and likely future characteristics of interest for the forecasting procedure.

- Association of Bay Area Governments, Projections '85 and Projections '87

- Wells Fargo Bank, "San Francisco - Its Economic Future," June 1987

- Institute for the Future, "Jobs/Housing Relationship" and "Economic Base/Employment Opportunities," Special Studies for Mission Bay, September 1986

- U.S. Department of Commerce, Bureau of Economic Analysis, 1985 OBERS BEA Regional Projections, Vol. 2, Metropolitan Statistical Area Projections

- Pacific Gas and Electric Company, "Service Area Economic and Demographic Forecast Reports," Golden Gate Region, March 1987

- National Planning Association, Regional Economics Projections Series, 1986

- U.S. Department of Labor, Bureau of Labor Statistics, Employment Projections for 1995: Data and Methods, Bulletin 2253, April 1986

- California Department of Finance, "Population Projections for California Counties 1980-2020 with Age/Sex Detail to 2020 DOF Baseline 86," Report 86-P-3, December 1986

- California Employment Development Department, Estimated Number of Wage and Salary Workers by Industry, San Francisco Annual Averages, 1972-80; Wage and Salary Employment by Industry, San Francisco City and County, December 1980 - December 1984; and Wage and Salary Employment by Industry, December 1983 - December 1986, in Annual Planning Information: San Francisco City and County, 1985-1986, May 1985

- Articles and reports describing the outlook for the economy in general, specific business sectors, the real estate market, and the labor force

Relationship of Office Forecasts to Proposition M Limit on Office Development Approvals

Background and Assumptions

To incorporate the Proposition M annual limit into the office forecasts, consideration was given to what the limit would be, whether there would be exemptions, how approvals would be allocated within the City, and how the market would react to limits on the supply of space. The following points explain the considerations involved and identify assumptions made for the analysis.

- Analysis of how the Mission Bay EIR office space forecasts relate to the Proposition M annual limit is conducted for two time periods: 1986-2000 and 2001-2020. The associated project approval periods have different starting and ending years, because of the lag between project approval and project occupancy. Since it typically takes about three years from the time an office project is approved until it is ready for occupancy, office development approvals through 1997 would provide the new space available for occupancy by the year 2000. Thus, for the first forecast period, the associated approval period is 1986-1997. The Department of City Planning has determined that the amount of office space allowed to be approved under Proposition M will be limited to 475,000 square feet each year through 2000 (see VI.B, p. VI.B.27). Thus, under a strict interpretation of Proposition M, 5.7 million square feet of additional office space could be approved during the twelve years from 1986 through 1997 to provide space available for occupancy by 2000. (12 x 475,000 = 5,700,000)

  For the second forecast period, the associated approval period is 1998-2017. Proposition M is assumed to continue in effect through that period. The 475,000 square foot annual limit is assumed to apply during the three years 1998-2000. During the next 17 years (2001-2017), the full Proposition M annual limit of 950,000 square feet is assumed to apply. Under the limitations of Proposition M, a total of 17.575 million square feet of additional office space could be approved over the 20 years from 1998-2017 to provide space available for occupancy by 2020. [(3 x 475,000) + (17 x 950,000) = 17,575,000]

- Proposition M allows voter-approved exemptions from the annual limit. Other future voter initiatives or litigation also could result in changes to, or invalidation of, parts or all of Proposition M. It is difficult to anticipate if such events would result in more space being approved than assumed as described above.

  For this EIR, it is assumed that Mission Bay would be exempt from the annual limit on office development approvals (see Chapter IV. Study Approach and Organization, p. IV.11). For a conservative cumulative impact assessment it is reasonable to assume that an additional amount of office space in the Downtown & Vicinity excluding Mission Bay could be approved and exempted from the annual limit during the forecast period.

- Since the annual limit on office development approvals applies citywide, consideration of how approvals would be allocated between the Downtown & Vicinity and the rest of the City was required. Although it is difficult to predict the outcome in advance, it is reasonable to assume that downtown office space would represent most of all space approved. The Downtown & Vicinity includes most of the City's office space in projects 25,000 square feet or larger. In addition, market conditions and zoning policies will continue to

encourage major office development in the Downtown & Vicinity. The assumption that most office space approved would be in the Downtown & Vicinity also presumes that large amounts of office space such as that in master-planned developments outside the area (e.g., Executive Park) would be exempt from the annual limit if they were to be built. That also is a conservative assumption for cumulative impact assessment.

- If the amount of space approved under the annual limit were less than the amount demanded to accommodate employment growth, market adaptations would occur: lower office vacancy rates, more intensive use of space (i.e., higher employment densities) and higher rents. As market pressures build, the resultant tight market situation eventually might slow or limit employment growth. Proposition M also could have a more direct effect on demand for space before those types of market reactions occurred. For example, expectations of higher rents and of difficulty finding space could lead business owners to seek other locations even though tight market conditions did not yet exist (and may never exist if enough businesses were to seek other options).

  Forecasting for this EIR assumed that demand for office space would not be deterred because of expectations of higher rents or shortages of space in the future. To the extent demand exceeded the ability to add office space during the forecast period, employment densities would increase and/or vacancy rates would decline.

Comparison of Approvals Allowed Under Proposition M to Office Space Forecasts Through 2000

As described in VI.B, p. VI.B.63, office growth in the Downtown & Vicinity through 2000 would be accommodated through absorption of space from a variety of sources (see Table XIV.B.13). To provide the total amount of office space in the Downtown & Vicinity that would accommodate total office employment forecast for 2000 and a 5% vacancy factor would require adding about 30 million square feet to the stock of <u>occupied</u> space in 1985. Those additions would come from: absorption of the large amount of space that was vacant in 1985 (accounting for about 40% of the addition of occupied space), occupancy of space in projects added to the stock in the mid- to late-1980s that were approved before October 1986 (accounting for about one-third of the addition of occupied space), and development of other new space approved after October 1986 (accounting for about one-quarter of the addition). Mission Bay office space would be part of that latter group as would other office projects proposed for the Downtown & Vicinity. The analysis outlined in Table XIV.B.13 demonstrates that most of the additional occupied space 1986-2000 would come from building stock that is not affected by the Proposition M annual limit.

Mission Bay office development and other new project proposals since October 1986 potentially would fall under the Proposition M annual limit. As noted above, to allow for timely development of the Project Area Alternatives that are the subjects of this EIR, Mission Bay office development was assumed to be exempted from the Proposition M annual limit by City voters. Table XIV.B.14 presents a comparison of the remainder of the additional space required, about six million square feet, to an estimate of the amount of additional office space that could be approved under Proposition M limits between 1986 and 1997. Assuming 85% of the citywide limit would be captured by projects in the Downtown & Vicinity, 4.8 million square feet could be approved in the Downtown & Vicinity by 1997. That would leave about one million square feet unaccounted for. That amount of additional space could come from other voter-exempted projects in the Downtown & Vicinity besides Mission Bay or projects approved as a consequence of

TABLE XIV.B.13: SOURCES OF OFFICE SPACE IN THE DOWNTOWN & VICINITY, 2000
(Thousands of Gross Square Feet)

	Scenario for Alternative A	Scenario for Alternatives B and N
Office Space in 2000		
Occupied	94,884	94,459
Vacant	+4,700	+4,685
TOTAL	99,584	99,144
Subtract: Occupied Space in 1985	-68,963	-68,963
Result: Office Space to Accommodate Employment Growth and 5% Vacancy in 2000	30,621	30,181
Sources of Office Space - 1986-2000		
Vacant Office Space - 1985	12,838	12,838
Space in Projects Completed, Under Construction or Approved as of October 1986	10,436	10,436
Mission Bay Office Space by 2000	1,440	1,000
Remainder to Be Approved - 1986-1997	5,907	5,907

SOURCE: Recht Hausrath & Associates

changes in interpretation of Proposition M over time. If more of the citywide allocation were captured by projects in the Downtown & Vicinity, then the amount of additional space outside the Proposition M limitation would be smaller. If 100% of the office space approved during the 1986-1997 were in the Downtown & Vicinity, then only about 200,000 square feet of space would be unaccounted for. That is a small amount relative to total office space in the Downtown & Vicinity.

The estimates of office space to accommodate office employment in 2000 are based on the assumption that office density (gross square feet per employee) would be about 2% higher than otherwise in 2000. In other words, office activities in 2000 would use less space than they otherwise might in the future for the same amount of employment. That assumption reflects a tighter market situation in the future (lower vacancies and increases in rent levels) as the annual limit begins to affect the supply of office space.

If the amount of space that would not be covered by approvals according to the annual limit (about one million square feet in the case illustrated in Table XIV.B.14) were not allowed, office employment growth could still occur as forecast if densities were more than 2% higher or if the office vacancy rate were less than 5% in 2000. On the other hand, if the employment growth did not occur, then the forecasts for 2000 would be lower than shown in the EIR and impacts of growth would be less than indicated.

TABLE XIV.B.14: COMPARISON OF OFFICE SPACE APPROVALS IN THE DOWNTOWN & VICINITY TO ACCOMMODATE OFFICE EMPLOYMENT GROWTH THROUGH 2000 WITH PROPOSITION M ANNUAL LIMIT

	Scenario for All Alternatives (square feet)	Assumptions
Office Space in the Downtown & Vicinity in Addition to Mission Bay Office Space Assumed to Be Approved 1986-1997 per Forecast/a/	5,907,000	Mission Bay exempt from annual limit and not included in this amount.
Approvals Allowed Under Proposition M Annual Limit 1986-1997	4,800,000	On average, 85% of approvals are for projects in the Downtown & Vicinity (85% of 475,000 = 400,000). Therefore, average of 400,000 square feet of space approved each year for the Downtown & Vicinity over 12 years.
Difference	1,107,000	Space added outside the annual limit (through exemption, successful litigation, revision or elimination of the limit).

/a/ This is the amount of office space that would have to be approved under the Proposition M annual limit from 1986-1997. The estimate is of the remainder of additional office space required to accommodate office employment growth and 5% vacancy in 2000, after accounting for absorption of vacant space in 1985; projects already completed, under construction or approved, as of October 1986; and the amount of office space in Mission Bay (assumed to be exempt from the annual limit) that would be developed by 2000. Those sources (and the remainder) are identified in the preceding table (Table XIV.B.13).

SOURCE: Recht Hausrath & Associates

The Mission Bay EIR office forecast through 2000 could be called a "conservative Proposition M scenario" in that it assumes more space is added than would be allowed under a strict interpretation of the annual limit. The approach is reasonable and results in more growth rather than less for cumulative impact assessment. Since employment rather than space is the key factor for most cumulative impact analyses, it is appropriate to develop a scenario that tends towards the high side, especially considering the uncertainties surrounding interpretation and use of Proposition M over the long term as well as the possibility for adaptations (higher densities, lower vacancies) that result in more employment accommodated in existing space.

Comparison of Approvals Allowed Under Proposition M to Office Space Forecasts 2001-2020

Comparison of the Mission Bay EIR office space forecasts to the amount of space allowed under the Proposition M annual limit for the second forecast period (2001-2020) is simpler than the comparison for the preceding period. By 2000, the stock of other available space to be absorbed would be reduced to levels more normal for the real estate market. Assuming Mission Bay office development beyond 2000 would continue to be exempt from the annual limit, approval of other projects under Proposition M would be the sole source of additions to the stock of office space.

Table XIV.B.15 presents the comparison for the 2001-2020 period. What was presented on two tables to describe the earlier period is here combined on one table. Depending on the Alternative, about 13 to 15 million square feet of additional office space would be required to accommodate office employment growth in the Downtown & Vicinity from 2001-2020 (assuming 5% vacancy in 2020 and constant employment densities after 2000). That amount is about half of the amount forecast for the earlier period (see Table XIV.B.13) due to the slower rate of employment growth expected over the longer term. With Alternative A, Mission Bay development remaining to be occupied beyond 2000 would account for some of the additional space. With Alternatives B and N, all Mission Bay office development would be occupied by 2000, so Mission Bay would contribute nothing to the supply of space beyond 2000. Depending on the Alternative, about 12 to 13 million square feet of additional office space excluding Mission Bay would be required to accommodate forecast office employment growth in the Downtown & Vicinity. As indicated in the table, that amount could be achieved within the limitations of Proposition M. Assuming the Proposition M annual limit remained in effect at 950,000 square feet per year beyond 2000, office projects to accommodate the Mission Bay EIR office employment scenarios for 2020 in the Downtown & Vicinity would require about 70% of the total amount of office space that could be approved citywide.

<u>Combining Business Activity Categories for the Project Area with Those for the Downtown & Vicinity</u>

To present forecasts of employment by business activity and space by use for the entire Downtown & Vicinity for 2000 and build-out/2020 required combining forecasts by business activity for the Downtown & Vicinity excluding Mission Bay with estimates of employment and space by use for the Project Area in 2000 and build-out/2020. The estimates of future employment and space for the Project Area reflect use categories and levels of detail specific to that area. In 2000, they also reflect an array of existing remaining activities categorized according to the 1985 Project Area estimates in more detail than used to describe those types of business activities in the other parts of the Downtown & Vicinity in the future. (See Table VI.B.2, p. VI.B.5, and Table VI.B.3, p. VI.B.6, for the categories used to describe existing Project Area space and employment in 1985. See Table XIV.B.2, p. XIV.B.5, and Table XIV.B.3, p. XIV.B.6, for more detail on existing Project Area space and employment in 1985.)

TABLE XIV.B.15: COMPARISON OF OFFICE SPACE APPROVALS IN THE DOWNTOWN & VICINITY TO ACCOMMODATE OFFICE EMPLOYMENT GROWTH 2001-2020 WITH PROPOSITION M ANNUAL LIMIT (Thousands of Gross Square Feet)

Office Space in 2020	Scenario for Alternative A	Scenario for Alternatives B and N	Assumptions
Occupied	108,500	106,600	
Vacant	+5,700	+5,600	
TOTAL	114,200	112,200	
Subtract: Total Office Space in 2000	-99,584	-99,144	
Result: Office Space to Accommodate Employment Growth and 5% Vacancy in 2020	14,616	13,056	
Sources of Office Space - 2001-2020			
Mission Bay Development	2,660	0	Mission Bay exempt from annual limit
Other Projects to Be Approved	11,956	13,056	
Approvals Allowed Under Proposition M Annual Limit - 1998-2017	17,575	17,575	3 years (1998-2000) @ 475 per year plus 17 years (2001-2017) @ 950 per year
Projects in the Downtown & Vicinity Excluding Mission Bay as a Percent of Total Approvals Allowed Citywide	68%	74%	

SOURCE: Recht Hausrath & Associates

Table XIV.B.16 shows the correspondence between business activity categories for the Downtown & Vicinity and categories for the Project Area in 2000 used to develop the combined total employment forecast for each Alternative presented in Table VI.B.17, p. VI.B.54. "Existing remaining" employment, east and west of Third Street, was disaggregated to Downtown & Vicinity business activity categories according to the types of businesses identified in 1985 in those areas presumed to remain undisturbed by new development through 2000. The Esprit store is represented by the employment estimate of 265. It is categorized as "retail" for the Downtown & Vicinity totals. For analyses of Project Area employment it is categorized as S/LI/RD in Alternative A and "existing remaining east of Third" in Alternatives B and N.

Table XIV.B.17 shows the correspondence for producing the combined build-out/2020 employment forecasts. The table is simpler than the preceding one since the smaller categories are combined as "all others." Also, at build-out, there is no longer any reason to track "existing remaining" employment in the Project Area (a designation used for the interim analysis year only).

The correspondence between use categories for space in the Downtown & Vicinity and the Project Area is similar to that outlined in Table XIV.B.17 for employment at build-out/2020. All Project Area building space except for office, retail and hotel space is combined in the "all others" space use category. For the year 2000, that includes existing remaining building space. The Esprit store, represented as 45,000 square feet of building space, is treated separately. For the year 2000 estimates for the Downtown & Vicinity, it is categorized as retail space for all Alternatives, not as S/LI/RD or "existing remaining" (i.e. "all others") building space. For the build-out estimates of Downtown & Vicinity totals, the Esprit store also is categorized as retail space. For Project Area analyses, it is accounted for as S/LI/RD space in Alternative A and Port-related/M-2 space in Alternative N.

<u>Procedure and Assumptions for Estimating Project Area Construction Employment</u>

Mission Bay Project Area development would generate construction employment. The steps and assumptions for calculating the estimates presented in the text (Table V.6, p. V.35 and Table VI.B.31, p. VI.B.90) are outlined below. The procedure for estimating employment associated with building and related development is shown separately from that for estimating employment associated with infrastructure development. The steps also identify the difference between the calculation for total person-years and that for average annual construction employment (used to illustrate the general level of construction employment in the Project Area in any one year during the development period).

Building and Related Development - Procedure

<u>Total Person-Years and Average Annual Construction Employment:</u>

- Calculate gross square feet of new development by use
- Multiply amount of new development by estimated development cost per square foot by use
- Sum total development cost for all uses
- Multiply total development cost by factor representing percentage of total cost attributable to on-site construction labor

TABLE XIV.B.16: CORRESPONDENCE BETWEEN BUSINESS ACTIVITY CATEGORIES FOR THE DOWNTOWN & VICINITY AND LAND USE CATEGORIES FOR THE PROJECT AREA, 2000

Business Activity Categories for the Downtown & Vicinity	Project Area Land Uses, 2000: Alternative A	Project Area Land Uses, 2000: Alternative B	Project Area Land Uses, 2000: Alternative N
Office	Office	Office	Office
Retail	Retail +265 S/LI/RD/a/	Retail +265 existing remaining east of Third/a/	Retail +265 existing remaining east of Third/a/
Hotel	Hotel	NA	NA
Sales/Showroom	0	0	0
Cultural/Institution/Educational	0	0	0
S/LI/RD & M-2 Industrial	S/LI/RD -265 (to retail)/a/	0	M-2 Industrial
Services	Housing-related, community facilities/open space, CalTrain Station and pump station, building maintenance/security and parking, +50 existing remaining east of Third, +150 existing remaining west of Third	Housing-related, community facilities/open space, CalTrain Station and pump station, building maintenance/security and parking, +195 existing remaining east of Third, +150 existing remaining west of Third	CalTrain Station and pump station, building maintenance/security and parking, +265 existing remaining east of Third, +550 existing remaining west of Third
Distribution and Manufacturing	50 existing remaining east of Third +100 existing remaining west of Third	200 existing remaining east of Third +100 existing remaining west of Third	270 existing remaining east of Third +370 existing remaining west of Third
Construction	Construction	Construction	Construction

NA - Not applicable.

NOTE: The correspondences presented in the table supplement totals for the Downtown & Vicinity shown in Table VI.B.17, p. VI.B.54. See Table V.6, p. V.35, for estimates of Project Area employment by use by Alternative.

/a/ The existing Esprit Store in the Project Area is represented by the employment estimate of 265. Although the store is a retail establishment, it is categorized as a S/LI/RD use in Alternative A, since it could be accommodated in its existing location under the S/LI/RD land use designation in that Alternative. In Alternatives B and N, the Esprit Store remains in the undeveloped portion of the Project Area east of Third Street in 2000. For inclusion as part of the Downtown & Vicinity totals, the activity is categorized as retail.

SOURCE: Recht Hausrath & Associates

TABLE XIV.B.17: CORRESPONDENCE BETWEEN BUSINESS ACTIVITY CATEGORIES FOR THE DOWNTOWN & VICINITY AND LAND USE CATEGORIES FOR THE PROJECT AREA, BUILD-OUT/2020

Business Activity Categories for the Downtown & Vicinity	Project Area Land Uses, Build-out/2020		
	Alternative A	Alternative B	Alternative N
Office	Office	Office	Office
Retail	Retail +265 S/LI/RD/a/	Retail	Retail +265 Port-Related/M-2/a/
Hotel	Hotel	NA	NA
All Others	S/LI/RD -265 (to retail)/a/, housing-related, community facilities/open space, CalTrain Station/pump station, building maintenance/security and parking	S/LI/RD, housing-related, community facilities/open space, CalTrain Station/pump station, building maintenance/security and parking	M-2 Industrial, Port-Related/M-2 -265 (to retail)/a/, community facilities/open space, CalTrain Station/pump station, building maintenance/security and parking

NA - Not applicable.

NOTE: The correspondences presented in the table supplement totals for the Downtown & Vicinity shown in Table VI.B.24, p. VI.B.72. See Table V.6, p. V.35, for estimates of Project Area employment by use by Alternative.

/a/ The existing Esprit Store in the Project Area is represented by the employment estimate of 265. In Alternative A and Alternative N, the store could continue to operate through build-out/2020 within the land use designation covering that location east of Third Street. Since the store is a large retail establishment, it is classified in the retail category for inclusion as part of the Downtown & Vicinity totals.

SOURCE: Recht Hausrath & Associates

- Divide total construction labor dollars by estimated average annual construction wage

- Result is total person-years of construction labor for specified amount of development

- Add factor for items not accounted for (wetlands development, community facilities and parking)

- Add factor for project management to determine grand total person-years

- Divide by number of years in development period to determine average annual construction employment

Building and Related Development - Assumptions

- Development Cost per Square Foot (1986 dollars):

Office	\$ 99
S/LI/RD and M-2 Industrial	\$ 55
Retail	\$ 83
Hotel	\$110
Port-Related/M-2	\$ 45
Housing (low and medium density)	\$ 83
Housing (medium-high and high density)	\$ 99

- Percentage of Total Development Cost Attributable to On-Site Construction Labor: 30%

  (Stan Smith, San Francisco Building and Construction Trades Council, telephone conversation, October 14, 1986 and Tom Thompson, Associated General Contractors, telephone conversation, October 14, 1986)

- Average Annual Construction Wage: \$43,000 (1986 dollars)

  (Stan Smith, telephone conversation, October 14, 1986 and Tom Thompson, telephone conversation, October 14, 1986)

- Factor for Project Management and Administrative Personnel: 20% of total person-years due to building development

Infrastructure Development - Procedures

- Determine construction costs for phased infrastructure and for major one-time improvements

For Total Person-Years:

- Multiply all infrastructure costs by factor representing percentage of total cost attributable to on-site construction labor

- Divide total construction labor dollars by estimated average annual construction wage

- Result is total person-years of construction labor attributable to infrastructure development

- Add factor for project management to determine grand total person-years

For Average Annual Construction Employment:

- Multiply phased infrastructure costs by factor representing percentage of total cost attributable to on-site construction labor

- Divide total construction labor dollars by estimated average annual construction wage

- Result is total person-years of construction labor attributable to phased infrastructure development

- Add factor for project management to determine grand total person-years

- Divide by number of years in development period to determine average annual construction employment

Infrastructure Development - Assumptions

- Costs for phased infrastructure estimated by KCA Engineers

  (See San Francisco Department of City Planning, "Infrastructure Costs: Mission Bay, San Francisco," Special Study for Mission Bay, prepared by KCA Engineers, Inc., September 1986, Table 1, p.4.)

  Phased infrastructure includes: fixed level canal, combined sewers, domestic water, high pressure water, joint trench utilities, street surface improvements, traffic signals, open space landscaping, and street landscaping.

- Costs for major one-time improvements are from a variety of sources:

  - China Basin Channel improvements, Channel Bridge and demolition (mostly I-280 freeway stub) estimated by KCA Engineers in "Infrastructure Costs: Mission Bay, San Francisco," Table 1, p.4.

  - CalTrain station re-location to Seventh and Channel estimated by Caltrans

    (San Francisco Department of City Planning, Inc., "CalTrain Station Locations, Mission Bay, San Francisco," Special Study for Mission Bay, prepared by Barton-Aschman Associates, Inc., September 1986, p. 58, and telephone conversation with Robert Harrison, transportation consultant to City of San Francisco for Mission Bay planning, October 14, 1986)

- MUNI-Metro extension estimated by DKS Associates

  (See San Francisco Department of City Planning, "Transportation Network: Mission Bay, San Francisco," Special Studies for Mission Bay, prepared by DKS Associates, September 1986, Table E-3, p. E-6.)

- New I-280 ramps at Sixth and King Streets estimated by Caltrans

  (telephone conversation with Robert Harrison, transportation consultant to City of San Francisco for Mission Bay planning, October 14, 1986)

- Percentage of Total Construction Cost Attributable to On-Site Construction Labor: 50%

  (William Barton, KCA Engineers, Inc., telephone conversation, October 14, 1986)

- Average Annual Construction Wage: $43,000 (1986 dollars)

  (Stan Smith, telephone conversation, October 14, 1986 and Tom Thompson, telephone conversation, October 14, 1986)

NOTES - Land Use, Business Activity, and Employment

/1/ See San Francisco Department of City Planning, Downtown Plan Environmental Impact Report (EIR), EE81.3, certified October 18, 1984, Vol. 1, pp. IV.B.1 - IV.B.13, for 1981 land use information for the C-3 District. See San Francisco Department of City Planning, South of Market Rezoning Study: Housing, Business Activity, Neighborhood Livability Research Findings, March 1985, pp. 67-78, for 1982 South of Market land use information.

/2/ The Standard Industrial Classification system was developed by the U.S. Office of Management and Budget to provide standard categories for reporting and documenting business and industry activity. The SIC system is used by local, state and federal agencies in reporting economic statistics. See Executive Office of the President, Office of Management and Budget, Standard Industrial Classification Manual, 1987.

/3/ See Downtown Plan EIR, pp. IV.C.1 - IV.C.25, for 1981 C-3 District employment estimates and other results of the C-3 District employer/employee surveys. See South of Market Rezoning Study, pp. 53-97 for 1982 South of Market employment estimates and other results of the South of Market employer/employee surveys.

/4/ The term "move-outs" refers to large-scale relocations of office employment from San Francisco, generally to suburban facilities. Most of the recent move-outs consisted of the back-office operations for larger companies (e.g., administrative and technical support operations, data processing, credit card operations). In the cases of some smaller companies, the entire office is relocated.

/5/ See Downtown Plan EIR, pp. IV.B.1-IV.B.13 and IV.C.1-IV.C.25 in particular.

/6/ Downtown Plan EIR, pp. IV.B.15-IV.B.16, p. IV.C.26, note /22/ on p. IV.C.58, and Appendix H. p. H.7.

/7/ ABAG's forecasts for total San Francisco employment can be disaggregated for subareas of the City for comparison to the Mission Bay EIR forecasts for the Downtown & Vicinity and the rest of the City. At the time this comparison was done as part of the economic analysis for the Mission Bay EIR, Projections '85 was the only set of ABAG forecasts available in a form enabling such disaggregation. Grouping Projections'85 forecasts for San Francisco by census tract into an area that approximated the Downtown & Vicinity results in numbers that can be compared to the 1986-2000 forecasts prepared for the Mission Bay EIR.

As noted in the text and in Table XIV.B.10, p. XIV.B.28, the Mission Bay EIR employment forecasts for San Francisco are higher than those in Projections '85. Most of the difference is concentrated in the Downtown & Vicinity. For the 1986 to 2000 period, the Mission Bay EIR forecasts employment growth of about 100,000 for the Downtown & Vicinity (see Table VI.B.22, p. VI.B.64). In Projections '85, the 1986 - 2000 employment forecast for the area approximating the Downtown & Vicinity is about 48,000. For the rest of the City, the forecasts are more similar: growth of about 35,000 jobs is forecast in the Mission Bay EIR, while growth of about 28,000 jobs is forecast in Projections '85. If similar comparisons were made using the updated Projections '87, it is likely that the larger growth forecast by ABAG for San Francisco would occur in the Downtown & Vicinity, thereby narrowing the difference between the ABAG and EIR forecasts for that part of the City.

/8/ The National Planning Association's Regional Economic Projections Series provides detailed employment forecasts by county through the year 2010. The Bureau of Economic Analysis' OBERS Regional Projections go further into the future with employment estimates for 2015 and 2035. The projections are for metropolitan statistical areas, so San Francisco is included with Marin and San Mateo Counties.

/9/ Analysis of age-specific labor force participation rates used information generated by ABAG in the course of that agency's work on Projections '87.

APPENDIX C. HOUSING AND POPULATION

HOUSING MARKET CONDITIONS IN THE BAY AREA AND SAN FRANCISCO

This section of the Appendix presents background information supporting the description of housing market conditions presented in VI.C. Housing and Population, pp. VI.C.1-VI.C.6. The following discussion focuses on housing market indicators and data describing housing production.

As discussed in the Setting section, demand for housing in the Bay Area region and San Francisco is strong, reflecting various attractive features of the area as a place to live. Since around 1970, housing demand has been further influenced by demographic and personal-choice factors as the baby-boom generation (usually defined as those born between 1946 and 1960) began forming their own households. Due to the large size of this group, the effects of its behavior and choices on housing demand were substantial.

In terms of housing supply, there was a net addition of 436,200 housing units in the Bay Area between 1970 and 1980, for an average net addition of about 44,000 units per year. Most of the additions were in the East Bay and the South Bay. The largest percentage increase in housing occurred in the North Bay./1/

In the early 1980s, housing production slowed dramatically. In both 1981 and 1982, only about 16,000 building permits were issued for housing throughout the region. More recently, however, the number of permits issued annually has increased substantially--to 44,000 in 1985. The type of housing being built has also changed. In 1980, one-third of the building permits issued were for multi-family housing; by 1985, more than half (55%) of the permits issued were for multi-family housing./2/

Vacancy data for the region reflect both strong demand and changing supply conditions. Vacancy rates throughout the region were less than 2% from the late 1970s through the early 1980s. By 1985, vacancy rates had increased to more than 2% in Contra Costa, Napa, Solano, and Sonoma Counties. The multi-family vacancy rates in these counties ranged from 3.7% to 5.1%. By 1986, the overall vacancy rate was almost 2% regionwide, with the multi-family rate at 3% regionwide./3/

The loosening of the market indicated by the increase in vacancy rates is reflected in residential rent levels. The Bay Area median advertised rent for a two-bedroom apartment peaked at about $700 per month in October, 1986 and remained at that level or slightly below through April 1987./4/

Market trend information on single family homes also reflects a slowing in the rate of appreciation of home values as supply and demand become better matched. Over the region as a whole, single-family home values increased almost four-fold between 1970 and 1980; the annual rate of increase in value was about 14% per year, compounded. Since 1980, the annual rate of increase in value was about 5-6%, about one-half the rate of the preceding decade. The pattern is similar among the East Bay, South Bay and North Bay housing sub-markets./5/

The pattern of housing production in San Francisco differed somewhat from that of the region, as the rate of net addition of new housing in the early and mid-1980's almost doubled the rate that occurred between 1970 and 1980 (see Table XIV.C.1).

The changing trend is attributable to both an increase in production and a decrease in housing demolition. Prior to 1977, demolition accounted for the loss of about 700 housing

TABLE XIV.C.1: NET ADDITION OF HOUSING IN SAN FRANCISCO

	1970/a/	1980/b/	1985/c/	Change 1970-1980	Change 1980-1985
Total Housing Units	310,402	316,608	322,706	+6,206	+6,098

/a/ U.S. Department of Commerce, 1970 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Table H-1.

/b/ U.S. Department of Commerce, 1980 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Table H-1.

/c/ California Department of Finance, Population and Housing Estimates for California Cities and Counties, for January 1, 1986, Summary Report E-5. Because the Department of Finance (DOF) provides consistent estimates of housing units, households and population for the years between the decennial Censuses, this series is used for 1985 estimates for the EIR. The DOF estimate for total housing units in this table is higher than the estimate prepared by the Department of City Planning on the basis of building permit data (+4,948). The City statistics track legal changes in the housing stock. The difference probably reflects the net addition of illegal secondary units which are not accounted for in City statistics.

SOURCE: Recht Hausrath & Associates

units per year. The public sector was responsible for more than half the demolition. The rate of residential demolition slowed substantially, to an average of 145 units per year in the 1980s. Most of the units demolished were replaced with higher-density housing. Since 1982, there has been no residential demolition by public action. On the production side, public sector activity has played a large role in the 1980s, with more than 40% of the completed units receiving development or financial assistance from a public agency or non-profit housing corporation./6/

POPULATION AND DEMOGRAPHIC TRENDS IN THE BAY AREA

Table XIV.C.2 presents population and household data for the rest of the region (the eight Bay Area counties outside San Francisco) in 1970, 1980 and 1985. The data provide background for the discussion in VI.C. Housing and Population, p. VI.C.9. The table shows the magnitudes for population, employed population and households in the rest of the region. The changes (1970-1980 and 1980-1985) illustrate the demographic trends described in the text.

MISSION CREEK HARBOR ASSOCIATION SURVEY

The Mission Creek Harbor Association represents the houseboat community and users of pleasure-craft berths in the China Basin Channel. With the cooperation of the Harbor Association, Recht Hausrath & Associates (RHA) conducted a survey of the houseboat residents and pleasure-craft users to gather information for the Mission Bay EIR. The survey took the form of a self-administered, mail-out/mail-back questionnaire and was conducted during February and March 1986.

TABLE XIV.C.2: REST OF REGION POPULATION, EMPLOYED POPULATION AND HOUSEHOLDS, 1970, 1980 AND 1985

	1970/a/	1980/b/	1985	1970-1980	1980-1985
Population	3,912,525	4,500,810	4,903,000 /c/	+588,285	+402,190
Population in Households/d/	3,810,510	4,404,102	4,788,964 /c/	+593,592	+384,862
Employed Population	1,505,046	2,174,827	2,475,630 /e/	+669,781	+300,803
Households	1,257,627	1,671,593	1,813,826 /c/	+413,966	+142,233
Persons per Household/f/	3.03	2.63	2.64		
Employed Persons per Household	1.20	1.30	1.36		

/a/ U.S. Department of Commerce, 1970 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Vallejo-Napa SMSA, Santa Rosa SMSA, and San Jose SMSA, Tables P-1, P-3, and H-1.
/b/ U.S. Department of Commerce, 1980 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Vallejo-Fairfield-Napa SMSA, Santa Rosa SMSA, and San Jose SMSA, Tables P-1, P-10, and H-1.
/c/ California Department of Finance, Population and Housing Estimates for California Cities and Counties, for January 1, 1986, Summary Report E-5.
/d/ Consistent with the definitions used by the U.S. Bureau of the Census, population in households includes all persons occupying housing units. People living in group quarters are counted separately. Total population is the sum of population in households and population in group quarters. From 1970 to 1980, the net change in population in households exceeds the net change in total population, indicating that the population in group quarters decreased. From 1980 to 1985, the net change in population in households was less than the net change in total population, indicating that the population in group quarters increased.
/e/ Recht Hausrath & Associates estimate using Department of Finance household estimates for counties and estimates of workers per household for counties from the Association of Bay Area Governments, Projections '85.
/f/ Calculated using population in households, which excludes population in group quarters. This is consistent with the Bureau of the Census measure of persons per household, calculated (as in the table above) by dividing the population in households by the number of households.

SOURCE: Recht Hausrath & Associates

RHA made initial contact with the Harbor Association, to which all houseboat residents and boat users must belong. The Harbormaster and the Steering Committee of the Harbor Association approved the concept of the survey and drafted a cover letter signed by the Harbormaster to accompany the questionnaire to encourage response; RHA also included an explanatory cover letter.

Using the mailing list of the members of the Harbor Association, RHA mailed questionnaires to each houseboat household and to each household using a pleasure-craft berth. There are 55 berths in the China Basin Channel: 20 houseboat berths and 35 pleasure-craft berths. Because some members of the Association use more than one berth, and in one case a berth is shared by two households, 46 households were sent questionnaires.

A stamped envelope addressed to the Harbormaster was included with each questionnaire. Each questionnaire had an identification number on its cover letter to help the Harbormaster monitor returns and follow up on slow respondents; once the cover letter was removed, however, the questionnaire became anonymous. The response rate for the houseboat survey was 85% (17 out of 20 households), while the response rate for the pleasure-craft users survey was 54% (19 out of 35 berths).

The houseboat resident questionnaire included questions about the number of people in the household, demographic characteristics, length of time in the area, approximate household income, employment, and commute patterns. The pleasure-craft users received an abbreviated questionnaire asking about the location of their primary residence, length of time using the berth in the Channel, frequency of boat use, means of transportation to the area, and parking requirements.

DOWNTOWN RESIDENTS SURVEY

Purpose

The Downtown Residents Survey was conducted by Recht Hausrath & Associates during May and June 1986. The purpose of the survey was to identify and document characteristics of residents of relatively new housing in and near downtown San Francisco. The characteristics of primary interest were the extent to which downtown residents also work downtown and the time and mode of travel for downtown residents' work trips. The survey results were an important source of information for defining the characteristics of future residents of Mission Bay housing and of other housing to be developed in the Downtown & Vicinity over the forecast period.

The survey is not a complete census of the residents of newer downtown housing, and does not substitute for Census data. Survey results were used in the EIR analyses in conjunction with Census data summarized for census tracts defining the Downtown & Vicinity. The limitations of Census data for the Mission Bay EIR analysis are that the data represent all residents, not just those in newer housing; and the 1980 Census was completed before some of the more recent downtown housing projects were occupied. Therefore, the Downtown Residents Survey filled a gap in information for Mission Bay EIR analyses.

Survey Design

The Downtown Residents Survey consisted of a self-administered questionnaire, each questionnaire representing one household. The population surveyed consisted of permanent residents of newer downtown housing projects; temporary residents (e.g., weekenders, those using downtown housing as a pied-a-terre) were asked to indicate same on the survey form and return the questionnaire unanswered.

The questionnaire had two types of questions. The first concerned the household as a whole: type of unit, tenure, household size, ages of residents, type of household, number of workers, and parking requirements. The second category of questions concerned workers in the household. The questionnaire provided for separate responses from each worker. The topics covered were: place of work, mode of travel to work, times for arriving at and leaving work, and distance walked to transit stop. There are consequently two sets of results: one summarizing responses of households and the other summarizing responses of all workers in those households.

A copy of the Downtown Residents Survey questionnaire and computer print-outs summarizing the results are on file at the Office of Environmental Review, Department of City Planning, 450 McAllister Street, San Francisco.

Survey Administration

Eight relatively new downtown residential projects initially were selected for the survey. The goal was to include projects that represented a range of types of newer housing in terms of location, owner or renter occupancy, and price/rent. Representatives of one of the eight projects approached refused to participate in the survey. The seven participating projects are listed below with a brief description of each.

- En Ville: 51 market-rate condominiums located on Gough Street between Golden Gate and McAllister.

- Fox Plaza: 446 market-rate rental units located on Market Street between Polk and Larkin.

- Golden Gateway Center: 1,254 rental units; initial rental below market rate, now market-rate; located on three blocks bounded by Drumm, Jackson, Battery, and Washington Streets.

- Golden Gateway Commons: 155 market-rate condominiums located on three blocks bounded by Drumm, Broadway, Front, and Jackson Streets.

- Opera Plaza: 462 condominiums with below-market financing available located on Van Ness Avenue at Golden Gate.

- St. Francis Place: 410 rental units of which 82 are reserved for low and moderate income households, located at Third and Folsom Streets.

- Telegraph Landing: 189 market-rate condominiums located at Sansome and Lombard Streets.

Questionnaires were distributed to all occupied units in these projects. Both St. Francis Place and Golden Gateway Commons recently had been completed and were not yet fully occupied.

All questionnaires were accompanied by a cover letter from the Department of City Planning. The distribution and collection of survey questionnaires was arranged with the cooperation of representatives of each project; the methods varied. For distribution, the Department of City Planning mailed questionnaires to two complexes: in two others,

property agents mailed or distributed the questionnaires; the residents' association handled distribution in two complexes; and in one project, the questionnaires were deposited in mail slots. For collection, two complexes mailed the questionnaires; two others deposited them in property manager's or residents' association mailboxes on the premises; three complexes designated drop-off baskets in the main lobby for the questionnaire return. The questionnaires were distributed beginning the first week of May 1986. Final collection was completed in the middle of June 1986.

Survey Response

The response to the survey was very good. A total of 2,664 questionnaires were distributed; 1,250 were returned, for an overall response rate of 47%. Sixty of the responses were from non-permanent residents, so the final tally was 1,190 valid household responses. There were 1,160 worker responses from the responding households. Table XIV.C.3 shows the number of questionnaires distributed, the number of responses, the response rate for each residential project, and the number of responses from permanent resident households.

TABLE XIV.C.3: RESPONSE RATES FOR THE DOWNTOWN RESIDENTS SURVEY

Project	Questionnaires Distributed	Questionnaires Returned	Response Rate	Responses from Permanent-Resident Households
En Ville	51	31	60.8%	31
Fox Plaza	390	164	42.0%	164
Golden Gateway Center	1,254	690	55.0%	665
Golden Gateway Commons	107	62	57.9%	45
Opera Plaza	451	161	35.7%	147
St. Francis Place	222	68	30.6%	65
Telegraph Landing	189	74	39.2%	73
TOTAL	2,664	1,250	46.9%	1,190

SOURCE: Recht Hausrath & Associates

Use of the Survey Results

There are two key things to understand about interpretation of the results of the Downtown Residents Survey. First, the sample is not (and was not intended to be) representative of all residents of downtown San Francisco. Second, the overall results do not necessarily represent the characteristics of residents of other new housing in the Downtown & Vicinity, such as that proposed for Mission Bay. For the Mission Bay EIR, the survey results were analyzed in a variety of different ways (by size of unit, by owner or renter, etc.) to determine how certain characteristics vary and to develop some of the information for defining characteristics of future Mission Bay and other downtown households. Other considerations, such as overall demographic trends that influence how future households might differ from today's households were also part of the Mission Bay EIR housing and population analyses.

When using the survey data, it is important to keep in mind the key factors which may affect interpretation of the survey results as examples of the characteristics of downtown households and of workers living downtown. Those factors include whether the households own or rent, whether or not there are workers in the household, household income, the price/rent of the unit, and how long the household has lived in the unit. With a general understanding of how these variables affect the results of the Downtown Residents Survey, it is possible to hypothesize how differences in those variables, related to both Mission Bay Alternatives and future conditions in general, may affect key household and worker characteristics of interest in the Mission Bay EIR and other studies.

BACKGROUND DATA FOR NEARBY AREAS

The following tables (Tables XIV.C.4-XIV.C.6, pp. XIV.C.8-XIV.C.11) present the basic data on population and housing for descriptions of each neighborhood in VI.C. Housing and Population, pp. VI.C.16-VI.C.26. For the purposes of data collection and analysis, the residential areas near Mission Bay were defined according to census tract boundaries. For each neighborhood, the tract or group of tracts was identified as that most closely conforming to general neighborhood boundaries. In the following tables, Census data have been aggregated according to these groupings to illustrate the size and characteristics of each neighborhood. The census tracts that make up each neighborhood are listed below./7/

Neighborhood	Census Tracts
South of Market	176.01, 176.02, 178, 179.01, 180
Potrero Hill	227
Lower Potrero / Central Bayfront	226
Inner Mission	177, 201, 202, 207, 208, 209, 210, 228, 229
South Bayshore	230, 231, 232, 233, 234, 606, 608, 609, 610

BACKGROUND FOR HOUSING, POPULATION AND JOBS/HOUSING ANALYSES

Introduction

This section of the appendix presents background information related to the cumulative population/employed population forecasts and the jobs/housing analysis in the EIR. As

TABLE XIV.C.4: POPULATION IN NEARBY AREAS, 1970 AND 1980

Area	1970	1980	Change 1970-1980 Number	Change 1970-1980 Percent
South of Market	10,682	10,051	-631	-5.9%
Potrero Hill/a/	9,291	8,562	-729	-7.8%
Lower Potrero / Central Bayfront/a/	654	537	-117	-17.9%
Inner Mission	51,874	50,226	-1,648	-3.2%
South Bayshore	30,064	21,638	-8,426	-28.0%
TOTAL FOR NEARBY AREAS	102,565	91,014	-11,551	-11.3%
TOTAL CITY	715,674	678,974	-36,700	-5.1%

/a/ Between the 1970 Census and the 1980 Census, there were changes in the census tract boundary separating these neighborhoods. Consequently, the changes shown here are approximations using block-level data from 1970 to establish comparable geographic areas for the two time periods.

SOURCE: Recht Hausrath & Associates' tabulations from U.S. Department of Commerce, 1970 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Table P-1, and 1980 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Table P-1.

described in Chapter IV. Study Approach and Organization, p. IV.3, the EIR analyzes Mission Bay Alternatives in a future context that incorporates other growth and change over time. The cumulative perspective takes in other City and regional growth, focusing specifically on the Downtown & Vicinity, of which Mission Bay would be a part.

Where appropriate and relevant, the EIR analyses used forecasts prepared by others. Examples are Association of Bay Area Governments (ABAG) forecasts of employment and population through 2000 for the rest of the region outside San Francisco and California Department of Finance (DOF) forecasts of population through 2020. Forecasts for the Downtown & Vicinity and the total City were prepared specifically for the Mission Bay EIR, however, to be sensitive to differences between Alternatives. The longer-term (2020) population and employed population scenarios for the Downtown & Vicinity, the City and the rest of the region also were prepared specifically for the EIR, since most available forecasts do not extend that far into the future.

This section of the appendix focuses on the approach and procedures for developing 1985 estimates and future scenarios, since the conclusions and rationale are presented

TABLE XIV.C.5: CHARACTERISTICS OF THE POPULATION AND HOUSEHOLDS IN NEARBY AREAS AS COMPARED TO TOTAL CITY, 1980

	South of Market	Potrero Hill	Lower Potrero / Central Bayfront	Inner Mission	South Bayshore	TOTAL CITY
Population	10,051	8,562	537	50,226	21,638	678,974
Households	4,986	3,775	244	20,058	7,150	298,956
	Distribution of Household Types: Percent of All Households					
Family Households	20.2%	47.2%	39.8%	47.8%	74.4%	47.0%
Non-Family Households	79.8%	52.8%	60.2%	52.2%	25.6%	53.0%
Living Alone as Percent of All Non-Family Households	91.1%	68.0%	71.4%	74.9%	84.3%	78.1%
	Poverty Status of Households, Families and Unrelated Individuals: Percent Below Poverty Level in 1979					
Total Households	25.4%	16.2%	22.5%	19.2%	19.7%	12.5%
Families	23.4%	23.0%	16.9%	18.5%	19.0%	10.3%
Unrelated Individuals/a/	30.5%	15.5%	34.2%	26.1%	30.0%	18.7%

TABLE XIV.C.5: CHARACTERISTICS OF THE POPULATION AND HOUSEHOLDS IN NEARBY AREAS AS COMPARED TO TOTAL CITY, 1980 (continued)

	South of Market	Potrero Hill	Lower Potrero/ Central Bayfront	Inner Mission	South Bayshore	TOTAL CITY
	Distribution of the Population by Race and Spanish Origin: Percent of Total Population					
Race/Ethnicity						
White	46.2	61.2	48.6	52.6	14.7	58.2
Black	15.0	23.9	40.2	5.7	73.0	12.7
American Indian, Eskimo, and Aleut	1.3	0.9	0.9	1.1	0.3	0.5
Asian and Pacific Islander	31.6	6.5	3.4	13.2	8.0	21.7
Other	5.9	7.5	6.9	27.4	4.0	6.9
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Spanish Origin/b/	11.9%	14.0%	12.5%	45.8%	1.4%	12.3%
	Distribution of the Population by Age: Percent of Total Population					
Age						
Less than 16	8.8	19.8	13.6	20.5	23.5	14.8
16-64	72.6	69.6	73.7	68.6	63.7	69.9
65 and Over	18.6	10.6	12.7	10.9	12.8	15.3
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

/a/ Poverty status is measured for all unrelated individuals 15 years and over. For this group, the percent refers to all unrelated individuals, not to the income status of households consisting of unrelated individuals.

/b/ Persons of Spanish origin may be of any race.

SOURCE: Recht Hausrath & Associates' tabulations from U.S. Department of Commerce, 1980 Census of Population and Housing: Census Tracts. San Francisco-Oakland SMSA, Tables P-1, P-7, and P-11.

TABLE XIV.C.6: CHARACTERISTICS OF THE HOUSING STOCK IN NEARBY AREAS, 1980

	Percent of Total Units					
	South of Market	Potrero Hill	Lower Potrero/ Central Bayfront	Inner Mission	South Bayshore	TOTAL CITY
Type of Unit/a/						
Owner-Occupied	2.0	33.5	25.7	13.4	55.4	31.9
Renter-Occupied	81.6	58.6	66.4	80.8	39.8	62.6
Vacant	16.4	7.9	7.9	5.8	4.8	5.5
TOTAL UNITS	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Percent Built 1939 or Earlier/b/	59.1%	59.0%	84.9%	67.5%	35.6%	57.7%
	Net Changes in the Housing Stock: 1970-1980, 1980-1985, 1986					
Time Period						
1970-1980/c/	-1,236	+505 /d/	+22 /d/	+299	-1,461	+5,987
1980-1985/e/	+42	+125	-2	+274	+462	+4,948 /f/
During 1986/g/	+409	+10	-1	+289	+75	+1,334

/a/ U.S. Department of Commerce, 1980 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Table H-1.
/b/ U.S. Department of Commerce, 1980 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Table H-7.
/c/ U.S. Department of Commerce, 1970 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Table H-1 and 1980 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Table H-1.
/d/ Between the 1970 Census and the 1980 Census, there were changes in the census tract boundary separating these neighborhoods. Consequently, the changes shown here are approximations using block-level data from 1970 to establish comparable geographic areas for the two time periods.
/e/ San Francisco Department of City Planning, Housing Information Series, Changes in the San Francisco Housing Inventory, reports for 1980, 1981-1982, 1983-1984 and 1985. The total change for 1980 has been adjusted across the board to account for the Census total measured in April 1980. Per conversations with Peter Groat of the Department of City Planning, two-thirds of the total 1980 net addition is calculated as the part of the 1980 change occurring after the Census.
/f/ This number is different from the total change in housing units citywide shown elsewhere in this EIR (see Table XIV.C.1, p. XIV.C.2 and Table VI.C.1, p. VI.C.8). This number is directly from City data reflecting changes to the City's legal housing stock, as measured by building permits. Illegal conversions of residential to non-residential use and illegal creation of residential units are not counted in City data, though they are counted in the decennial Census. The Department of Finance estimate of total housing units in 1985 implies a larger change (+6,098) from the 1980 Census. This larger estimate suggests that the net result of illegal conversions and illegal creation of units was an increase of housing in the City. The smaller number from published City data is used here for comparability with the Census tract data used to describe the Nearby Areas.
/g/ San Francisco Department of City Planning, Housing Information Series, Changes in the San Francisco Housing Inventory: 1986.

SOURCE: Recht Hausrath & Associates

elsewhere in the EIR (see VI.C. Housing and Population, pp. VI.C.6-VI.C.16, VI.C.26-VI.C.35, and VI.C.38-VI.C.63). The appendix incorporates background tables to supplement summary discussion in the EIR text.

Methodology for Developing Cumulative Scenarios for Housing and Population

The Mission Bay EIR cumulative analyses use estimates of population and employed population for the Downtown & Vicinity, San Francisco and the rest of the region. The cumulative analyses for the Downtown & Vicinity and the total City also factor in housing units and households. The estimates are described in VI.C. Housing and Population, pp. VI.C.6-VI.C.16 and pp. VI.C.38-VI.C.51. That description incorporates discussion of how estimates for the "setting" and future analysis years were derived. This appendix section describes the methodology in more detail and identifies key data sources.

Estimates for 1980 and 1985

San Francisco and the Rest of the Region. The 1980 U.S. Census is the starting point for housing and population information in the EIR. Census data are presented in the EIR for the total City, the Downtown & Vicinity (as defined by 1980 census tracts) and the rest of the Bay Area region. The Census provides counts of population, housing units, households, and employed population as well as demographic characteristics of the population. Because the Census provides data (as opposed to estimates) and trends can be established between Census years using that data, it is an important foundation for other estimates and analyses dealing with population and characteristics of the population.

For 1985, the EIR presents estimates updating 1980 Census data. California Department of Finance (DOF) estimates of households and population (provided for each year and updated annually) are used for San Francisco and the rest of the region. Cumulative analyses also required estimates of employed population. Those estimates for San Francisco and the rest of the region consistent with DOF household estimates for 1985 were derived using workers-per-household factors. For San Francisco, the 1985 estimate of employed population was developed using the DOF household estimate and an estimate of workers-per-household (which is the same as the ABAG estimate of workers-per-household for San Francisco from Projections '85). For the rest of the region, the 1985 estimates of employed population are based on the 1985 DOF household estimates for counties and estimates of workers-per-household for counties from ABAG's Projections '85. The 1985 scenarios for households, population and employed population were evaluated in terms of what they implied about trends in household size, labor force participation and the distribution of housing and population growth throughout the region.

Detailed Analysis for San Francisco. For San Francisco in 1985, housing units also entered into the calculations, since they provided a basis for allocating households, population and employed population between the Downtown & Vicinity and the rest of the City. The DOF estimate was used as the basis for total housing units in the City in 1985, since it is consistent with household and population estimates. Further, it is developed based on a comprehensive approach that accounts for changes in addition to those identified by reported new construction and demolition including illegal secondary units and changes in the occupancy of existing stock./8/

The San Francisco Department of City Planning (DCP) tracks changes in the housing stock as evidenced by building permit records. The information is published each year as part of the Housing Information Series. Adding the changes since the 1980 Census count through 1985 to the 1980 Census count results in the official count for housing units in the City in 1985. That number is lower than the DOF estimate, implying that illegal secondary units

(not accounted for in City records) represent part of the addition to the City's housing stock since 1980. (See Table XIV.C.1, p. XIV.C.2.)

The change in housing stock 1980-1985 implied by the DOF estimate was compared to the change in households 1980-1985 (also from DOF). The result implied substantial absorption of vacant units as the increase in households exceeded the increase in housing units. That was consistent with observed trends. The DOF estimates of housing and households also were evaluated in light of DCP housing stock data and Federal Home Loan Bank vacancy data for 1985. Together, those factors illustrated a reasonable scenario of change from 1980 through 1985.

Since DCP housing data are tabulated by census tract, the Housing Information Series is a useful source for allocating changes in housing stock and, by implication, households and population, to districts of the City. That was the basis for the estimates for the Downtown & Vicinity derived for the EIR and for order-of-magnitude estimates for the rest of the City disaggregated into four areas (Northeast, Northwest, Southwest and Southeast) prepared as background for cumulative transportation analyses. Figure VI.C.1, p. VI.C.32, shows the boundaries of the districts used in the EIR analyses.

The procedure for developing 1985 estimates for districts of the City started with 1980 Census data for those areas, specifically total housing units. Net additions to the housing stock in each district through 1985 were calculated from the DCP housing data series. The results were added to the 1980 count of housing units. Since the 1985 estimate of total housing units in the City came from DOF and was somewhat higher than the total implied by the DCP net addition numbers, there was a residual addition (primarily representing secondary units not counted in building permit data) to be allocated among districts of the City. That amount of units was distributed to districts according to their share of total housing in the City in 1980.

Once total housing units by district were estimated for 1985, the next step was estimating households by district (i.e., occupied housing units). That was done using analysis of changes in housing vacancy rates for subareas of the City as measured by the Federal Home Loan Bank Housing Vacancy Survey, where citywide data is disaggregated by zip code. (The zip code areas were grouped to approximate the City districts used for analyses in the EIR.)

There are two components of the 1985 population estimates for districts of the City: population in households and population in group quarters. The DOF provides citywide estimates for both. The procedure for developing district estimates was iterative, involving household estimates for districts, persons-per-household factors for each district, and evaluation of the estimated distribution among districts. For the 1985 estimates, persons-per-household factors reflected the 1980 average household size for each district plus the overall percentage increase in household size implicit in the 1985 DOF citywide estimates. The DOF estimate for total city group quarters population in 1985 was distributed among districts of the City according to the percentage in each in 1980. The resultant estimates of total population by district (population in households plus population in group quarters) was evaluated in terms of the percentage change 1980-1985 and by comparing the 1985 distribution among districts to the 1980 distribution.

The 1985 estimates of employed population for districts of the City were derived using a similar procedure. Workers-per-household factors for each district that reflected 1980 characteristics plus the overall percentage increase implied by citywide estimates of employed population were applied to 1985 estimates of occupied housing units by district. The percentage distribution among districts resulting from that calculation was applied to the citywide total for employed population to provide final estimates for each district.

Thus, the 1985 estimates are tied closely to 1980 Census data. The updates to 1985 account for differences in household characteristics between districts (as documented in 1980 Census data) as well as differences in housing production documented by DCP data. The updating procedure used those differences to allocate changes from 1980 through 1985 evidenced by citywide estimates of population, employed population and households.

Sources. The following are the primary sources used to establish 1980 conditions and updates to 1985:

- U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, 1970 and 1980

- California Department of Finance, Population and Housing Estimates for California Cities and Counties, for January 1, 1986

- San Francisco Department of City Planning, Housing Information Series: Changes in the San Francisco Housing Inventory, reports for 1980, 1981-1982, 1983-1984, and 1985

- Federal Home Loan Bank of San Francisco, Housing Vacancy Survey: San Francisco County, September-November 1979 and September 1985

- Association of Bay Area Governments, Projections '85

Scenarios for 2000 and Build-out/2020

Procedure for Developing Citywide Scenarios. Cumulative analyses for the Mission Bay EIR required scenarios for population and employed population that were sensitive to differences between Alternatives in the Downtown & Vicinity and in the rest of the City. To analyze build-out of the Alternatives, the cumulative analyses also required longer-term scenarios through 2020. Projections prepared by ABAG (through 2005) and DOF (through 2020) were reviewed but were not adequate as sole sources for the EIR scenarios.

Of the two sets of scenarios presented in the EIR, those for 2020 are more speculative, providing order-of-magnitude parameters against which the effects of Alternatives can be evaluated. The same basic procedure was used to develop the Alternative scenarios for 2020 and for 2000. The procedure builds on the steps outlined above for the 1985 estimates.

For San Francisco totals, forecasts of population and employed population were derived from assumptions about housing production, housing vacancy, household size, and labor force participation. The City's Residence Element, in conjunction with consideration of differences in housing between Mission Bay Alternatives and what effect that might have on production elsewhere in the City, provided the basis for forecasting the potential amount and location of housing added in the City in the future. Before estimates for the Downtown & Vicinity and other subareas were prepared, however, citywide totals for population and employed population were evaluated. Analysis of past trends illustrated in Census data, recent trends evidenced by 1985 estimates, ABAG analyses and projections, and information on nationwide trends in labor force participation from the U.S. Department of Commerce, Bureau of Labor Statistics and Bureau of Economic Analysis provided the basis for assumptions about future household size and labor force participation in San Francisco. Assumptions about persons-per-household and workers-per-household were evaluated based on comparison of scenarios for San Francisco population/employed population to scenarios for San Francisco employment and San Francisco workers also living in the City.

Population and employed population forecasts for the City were allocated among districts of the City. As for the 1980-1985 updates, the procedure began with housing units forecast to be added in each district. Vacancy rate assumptions were applied to derive estimates of additional households. Population scenarios for each district reflected assumptions about household size (persons per household) for new housing as well as changes in the overall average for those in existing housing. In addition, future scenarios for population in group quarters were developed. Employed population scenarios for each district also used assumptions about workers per household for new housing and changes in the overall average for those in existing housing.

The future scenarios of housing, households, population, and employed population were evaluated in terms of the resultant distribution among areas of the City and how the locational pattern appeared to change over time. In addition, the ratio of employed population to population for each area and the City as a whole was used to check on labor force participation assumptions.

The future context for San Francisco housing, population and employed population presented in the EIR shows citywide totals and subtotals for the Downtown & Vicinity (including Mission Bay) and the rest of the City (see Table VI.C.9, p. VI.C.39, and Table VI.C.11, p. VI.C.47). Those are the most important analytical distinctions for most of the cumulative analyses. Scenarios for the four other districts of the City were developed to provide background parameters for certain aspects of the transportation analysis.

Regional Context. For 2000, as with employment, the scenarios for population and employed population for the rest of the region outside San Francisco are those developed by ABAG and published in Projections '85. Consequently, the year 2000 scenarios for relationships between employment and population are internally consistent.

For build-out/2020, the only available forecasts are those for population (by age and sex) prepared by DOF. The DOF 2020 population projections were the basis for the scenario for the rest of the region to accompany build-out of Mission Bay. The DOF population projections were evaluated in light of trends identified through 2005 in the updated ABAG Projections '87. Adjustments were made to DOF's 2020 population projections based on the longer-term trends reflected by ABAG. To develop scenarios for employed population in 2020 required analyses of the demographic trends implied by the DOF projections in light of longer-term employment growth and labor supply issues. A longer-term scenario for labor force participation was developed. Before the 2020 regional scenarios were finalized, a consistent and supportable relationship between employment and employed population was established.

Sources. The following are the primary sources used to develop the cumulative scenarios for 2000 and build-out/2020.

- Association of Bay Area Governments, Projections '85 and Projections '87

- California Department of Finance, Population Projections for California Counties 1980-2020 with Age/Sex Detail to 2020: DOF Baseline 86

- U.S. Department of Commerce, Bureau of Economic Analysis, 1985 OBERS BEA Regional Projections, Volume 1, State Projections to 2035

- U.S. Department of Labor, Bureau of Labor Statistics, Employment Projections for 1995: Data and Methods, April 1986, and Employment Projections for 1995, March 1984

- U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, "Projections of the Economy, Labor Force and Occupational Change to the Year 2000," September 1987, Vol. 110, No. 9, pp. 3-63.

Background on Relationship Between Employment and Employed Population at the Regional Level

It is important for cumulative analysis that scenarios of employment and population/employed population are consistent and make sense in terms of both economic growth and the ability of the region's labor pool to supply the workforce for jobs in the region. Throughout the process of developing scenarios for the EIR, the match between employment and employed residents was used to evaluate San Francisco and regional scenarios of growth and change. The results of that analysis and comparison are described on pp. VI.C.52-VI.C.55. Table XIV.C.7 presents the comparison of the regional scenarios used in the EIR.

Comparison to Other Forecasts

Forecasts for San Francisco. There are two other sources for forecasts for San Francisco. The California Department of Finance (DOF) prepares population projections for California counties. The Association of Bay Area Governments (ABAG) prepares projections of households, population, employed population, and employment for the nine Bay Area counties. ABAG's Projections '85 were the most current regional forecasts at the time the Mission Bay EIR forecasts were prepared. Since then, the ABAG forecasts have been revised and published in Projections '87. These other forecasts were reviewed as part of the background analyses for the Mission Bay EIR forecasts, but they were not used directly as the San Francisco forecasts for cumulative impact assessment. That is because EIR scenarios for San Francisco had to consist of forecasts sensitive to different Mission Bay Alternatives and also had to be disaggregated to forecasts for the Downtown & Vicinity separate from the rest of the City. In any case, all the current forecasts of households, population and employed population in San Francisco reflect the same basic trends and outlook for the future (see Table XIV.C.8, p. XIV.C.18).

The growth of households in San Francisco as forecast in the EIR is very similar to ABAG's household forecast (see Table XIV.C.8, p. XIV.C.18). Although ABAG does not present a forecast of housing units, it also would be similar to the EIR forecasts if relatively constant vacancy were assumed.

There are some differences between forecasts of population growth in San Francisco. The EIR forecasts include more growth than the DOF projection and a little less growth than the revised ABAG forecast in Projections '87 (see Table XIV.C.8, p. XIV.C.18). The EIR forecasts show more population growth than the ABAG forecast for San Francisco in Projections '85 since that ABAG forecast was prepared before population growth trends since 1980 were documented. The differences in population growth between the forecasts are relatively small when compared to the large total population in the City./9/

Comparison of forecasts of employed population in San Francisco shows that the EIR forecasts are nearly the same as the ABAG forecast in Projections '85 (see Table XIV.C.8, p. XIV.C.18). The revised ABAG forecast in Projections '87 includes larger growth of the employed population of the City than does the EIR. The revised ABAG forecast reflects somewhat higher overall labor force participation of the City's population in the future.

Regional Relationship Between Employment and Employed Population. For the EIR, the relationship between employment and employed population at the regional level reflects the EIR forecasts for San Francisco and the ABAG forecasts from Projections '85 for the

TABLE XIV.C.7: RELATIONSHIP BETWEEN EMPLOYMENT AND EMPLOYED RESIDENTS OF BAY AREA REGION, 1985, 2000 AND BUILD-OUT/2020

	1985	2000	2020
Employed Residents/a/	2,847,650	3,628,800	4,063,000
Employment/b/	2,790,300	3,731,500	4,194,800
Resultant Net Out-Commuting	57,350 /c/		
Resultant Net In-Commuting		102,700 /d/	131,800 /d/

NOTE: The comparisons above are approximate and provide an indication of the relationship between regional employment and employed residents. The numbers include employment and employed residents in San Francisco and the other eight counties of the Bay Area region. The estimates for San Francisco in 2000 and 2020 are for Alternative A. Although there would be differences in San Francisco between Alternatives A, B and N, those differences are not large at the regional level. There would be offsetting effects: Alternatives with more (or less) employment (or employed residents) in San Francisco would result in less (or more) employment (or employed residents) elsewhere in the region.

/a/ See Table VI.C.11, p. VI.C.47, and Table VI.C.12, p. VI.C.50. What is referred to as employed population in those tables is called employed residents in this table. The title is different to avoid confusion when employment is shown on the same table. Employed residents refers to the employed population by place of residence. Employment refers to jobs by place of work.
/b/ See Table VI.B.27, p. VI.B.77, and Table VI.B.28, p. VI.B.79.
/c/ The 1985 estimates of employed residents and employment are not entirely comparable. The estimate of employment for counties outside of San Francisco includes wage and salary employment and does not include self-employed persons. If the self-employed were included the resultant estimate of out-commuters would be lower or the comparison could show net in-commuting. Given that the estimates are approximate, the comparison generally shows that the numbers of employment and employed residents at the regional level are about equal.
/d/ The comparisons of future employed residents and employment are approximate. The significance of the comparisons is that net in-commuting into the region is expected to increase in the future. The amounts per se are not as important.

SOURCE: Recht Hausrath & Associates

rest of the region (see Table XIV.C.7). For comparison, Table XIV.C.9, p. XIV.C.19 presents the regional scenarios of employment and employed residents using the ABAG projections for the total region, including San Francisco.

TABLE XIV.C.8: COMPARISON OF FORECASTS FOR SAN FRANCISCO HOUSEHOLDS, POPULATION AND EMPLOYED POPULATION, 1980, 1985 AND 2000

	1980	1985	2000	1986-2000
Households				
Mission Bay EIR	298,956 (1980 Census)	310,040 (DOF 1/1/86)	324,540 - 326,040 Alt. N Alts. A&B	+14,500 - +16,000 Alt. N Alts. A&B
ABAG *Projections '85*	298,956	308,020	322,550	+14,530
ABAG *Projections '87*	298,956	308,020	324,400	+16,380
Population				
Mission Bay EIR	678,974 (1980 Census)	741,570 (DOF 1/1/86)	782,630 - 785,780 Alt. N Alts. A&B	+41,060 - +44,210 Alt. N Alts. A&B
ABAG *Projections '85*	678,974	718,500	712,100	-6,400
ABAG *Projections '87*	678,974	718,500	773,700	+55,200
Department of Finance (DOF)	678,974	741,570	763,794	+22,224
Employed Population				
Mission Bay EIR	342,485 (1980 Census)	372,050	404,770 - 406,580 Alt. N Alts. A&B	+32,720 - +34,530 Alt. N Alts. A&B
ABAG *Projections '85*	347,092	369,600	406,400	+36,800
ABAG *Projections '87*	347,092	384,900	430,000	+45,100

SOURCE: Recht Hausrath & Associates and Association of Bay Area Governments (ABAG), *Projections '85* and *Projections '87*.

TABLE XIV.C.9: ABAG PROJECTIONS: RELATIONSHIP BETWEEN EMPLOYMENT AND EMPLOYED RESIDENTS OF BAY AREA REGION, 1985, 2000 AND 2005

	1985	2000	2005
Projections '85			
Employed Residents	2,808,400	3,628,600	3,812,500
Employment	2,780,450	3,652,090	3,910,950
Resultant Net Out-Commuting	27,950		
Resultant Net In-Commuting		23,490	98,450
Projections '87			
Employed Residents	2,879,400	3,595,000	3,730,800
Employment	2,805,100	3,713,000	3,894,000
Resultant Net Out-Commuting	74,300		
Resultant Net In-Commuting		118,000	163,200

NOTE: The numbers above are from the ABAG projections, including both Projections '85 and the updated Projections '87. The numbers are for the nine Bay Area counties including San Francisco (as forecast by ABAG). The comparisons are approximate and provide an indication of the relationship between regional employment and employed residents. The significance of the comparisons are that net in-commuting into the region is expected to increase in the future. Although the ABAG projections do not extend to 2020, the projections for 2005 are shown to provide an indication of trends beyond 2000.

SOURCE: Recht Hausrath & Associates based on Association of Bay Area Governments (ABAG) projections

Like the regional scenario in the EIR, the ABAG projections reflect an increase in net in-commuting into the region in the future. Compared to Projections '85, the EIR scenario expects a larger amount of in-commuting by 2000. The difference largely reflects higher employment growth in San Francisco without lower employment growth elsewhere in the region. (See pp. XIV.B.29-XIV.B.30 for background on employment forecasts for the rest of the region.) Compared to Projections '87, the EIR scenario includes a smaller amount of in-commuting by 2000, although the amounts are fairly similar. Under both projection series, ABAG expects an increase in net in-commuting after 2000. By that time, both ABAG and the EIR analyses expect that the Bay Area region as an economic unit will be larger than the present nine counties.

Methodology for Estimating and Forecasting Residence Patterns of Workers in the Downtown & Vicinity

This section focuses on the Downtown & Vicinity including Mission Bay. It provides background for estimates of places of residence of persons employed in downtown jobs, referred to as "residence patterns" of workers. It then describes the methodology for forecasts of future residence patterns. Supplemental tables summarizing residence patterns forecasts are included at the end of the section.

Establishing 1981 and 1985 Residence Patterns

Data for 1980 and 1981 provide the starting point for the analyses and forecasts of residence patterns. Census data are available for 1980 and the C-3 District Employer/Employee Surveys (providing information on where workers live) were done in 1981. Analyses were done to estimate residence patterns for workers in the entire Downtown & Vicinity (expanding the analysis beyond the C-3 District used in the Downtown Plan EIR) and develop estimates of residence patterns for 1985.

The following list identifies the sources for residence patterns. Generally, residence patterns were identified directly through surveys or by estimates developed using available survey data.

- C-3 District: 1981 C-3 District Employer / Employee Surveys
- South of Market: 1982 South of Market / Folsom Employer / Employee Surveys
- Civic Center / South Van Ness: 1981 Department of City Planning Civic Center TSM Survey for government workers, supplemented by residence patterns data for similar types of workers in other downtown areas from surveys listed above
- Northeast Waterfront: Approximated using residence patterns data for similar types of workers in other downtown areas from surveys listed above

Estimates of residence patterns of workers in each of the subareas, derived from the sources above, were combined to provide estimates for the Downtown & Vicinity (see Table VI.C.6, p. VI.C.30, and Table VI.C.7, p. VI.C.33). The estimates describe the number of workers in the Downtown & Vicinity residing in each corridor of the region (San Francisco, East Bay, South Bay, and North Bay) and the number residing in each of the nine Bay Area counties. Estimates also were developed for those living in the Downtown & Vicinity and other districts of the City used for transportation analyses.

For 1981, estimates were developed from the sources above and reviewed against the background of citywide and regional data from the 1980 Census. The places of residence for workers in the Downtown & Vicinity were evaluated within the context of the employed population of each place, other employment in both the City and the region, and commute travel patterns identified by Census journey-to-work data for 1980./10/

The residence patterns estimates were updated to 1985 considering changes from 1981 through 1985 in employment and employed population in San Francisco and throughout the region. The estimates were refined and verified through the transportation analysis. In

that analysis, workers by places of residence were distributed among modes of travel and times of day and the resultant estimates compared with recorded counts of trips on various transportation systems serving the downtown area (see XIV.E. Transportation, p. XIV.E.19).

Approach for Developing Scenarios of Future Residence Patterns

The future scenarios of residence patterns of workers in the Downtown & Vicinity were prepared by considering changes in employment within the context of assumptions about how other factors are likely to change over time. The diagram in Figure XIV.C.1 summarizes the types of factors considered and their inter-relationship. The following paragraphs elaborate on the factors identified in the diagram.

Among the four types of factors identified in Figure XIV.C.1, the number of jobs of various types in the Downtown & Vicinity is important since different jobs employ workers with different demographic and household characteristics and different housing preferences.

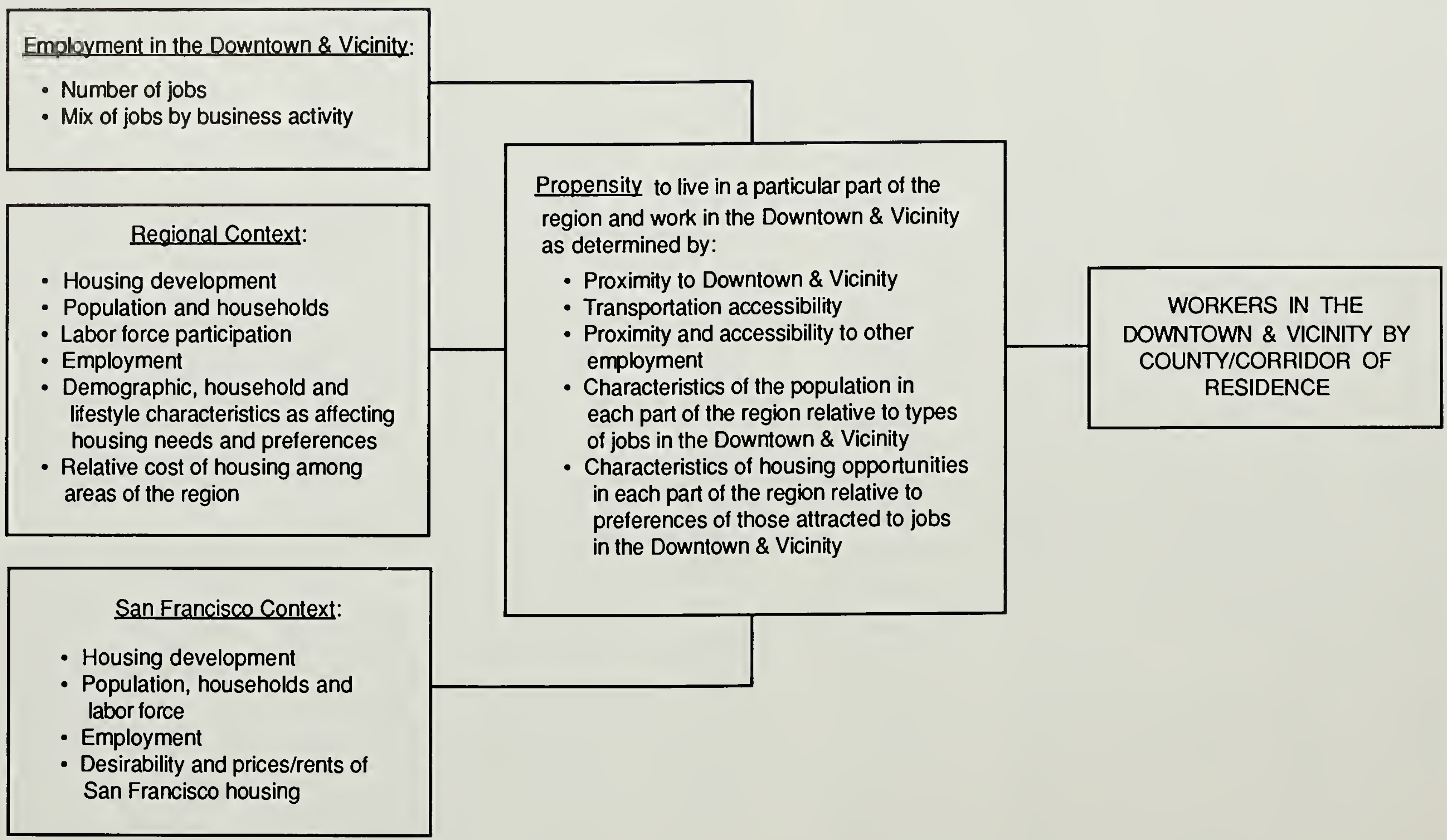
For forecasting residence patterns, the regional perspective on how the labor force is likely to increase over time and to be distributed among counties throughout the region is an important consideration. Employment growth elsewhere in the region also is taken into account, since employers in the Downtown & Vicinity compete with businesses in other locations to attract labor from throughout the region.

The future context for San Francisco is a specialized case within the regional context. Special attention is focused on San Francisco because of its importance in supplying labor for jobs in the Downtown & Vicinity, because the Alternatives affect housing supply in San Francisco, and because the analysis of impacts on the housing market in San Francisco is of particular interest in this EIR.

The fourth major factor considered in forecasting residence patterns is the "propensity" to live in a particular part of the region and work in the Downtown & Vicinity. That concept identifies the extent to which those employed in the area are drawn from the labor supply in various parts of the region. In other words, while the San Francisco and regional contexts identify the future supply and distribution of labor and jobs, the propensity factor identifies the share or percentage of labor in various locations that reasonably could be expected to work in the Downtown & Vicinity. The propensity factor reflects the relative differences between parts of the region in the time and cost of commuting to downtown San Francisco relative to other places of employment. It also reflects characteristics of housing opportunities in different parts of the region relative to housing preferences of those attracted to downtown jobs, and characteristics of the population in different parts of the region relative to types of job opportunities in the Downtown & Vicinity.

For the propensity factor, estimates were developed of the percentage of employed residents in each county who currently work in the Downtown & Vicinity (see Table VI.C.6, p. VI.C.30). Other information about commute patterns of workers in each county and employment throughout the region also was analyzed.

Changes over time in propensities were considered qualitatively based on a variety of information sources. Generally, the process was to develop a line of reasoning about how residence patterns have been changing (since trend data is limited) and to relate the changes to two types of factors. One is the extent to which the general distribution of housing and workers throughout the region has been changing. The other is the extent to



Mission Bay

SOURCE: Recht Hausrath & Associates

FIGURE XIV.C.1
DIAGRAM OF FACTORS CONSIDERED IN FORECASTING FUTURE RESIDENCE PATTERNS OF WORKERS IN THE DOWNTOWN & VICINITY

which commute patterns of residents in different areas have been changing. For example, during the 1970s population grew substantially in Contra Costa County, and the percentage of the region's population and housing located in the county increased. The propensity of Contra Costa County residents to commute to jobs in San Francisco also increased so that a larger percentage of the county's employed residents worked in San Francisco in 1980 than was true ten years earlier. The many reasons for those changes depend on all of the factors listed in Figure XIV.C.1.

Consideration of future changes in propensities to work in the Downtown & Vicinity followed a similar reasoning process. The analysis was qualitative including review of future employment, population, housing, and transportation factors, as well as past trends. The C-3 District and South of Market Folsom Employee Surveys also were useful since they included questions about the relative importance of various factors in a household's decision to choose a housing location or in a worker's decision to choose a job. Analysis of that data helped to identify the nature of trade-offs workers and households continually make as they are faced with changing employment and housing options.

Process of Developing Forecasts

The forecasts of future residence patterns of workers in the Downtown & Vicinity were developed in several steps considering all the factors described above. Census data were analyzed to provide insights into past and recent trends. In addition, the residence patterns forecasting analysis synthesized scenarios of future employment, housing, population, and employed population for the region and for San Francisco.

First, decisions were made as to the number and percentage of workers in the Downtown & Vicinity likely to reside in San Francisco and the number to reside outside of San Francisco. That was done considering total future employment in San Francisco, total employed population of the City, and the relationship between jobs and employed residents in the future (see pp. VI.C.53-VI.C.55).

Second, those workers forecast to live elsewhere in the region were distributed to commute corridors outside San Francisco (East Bay, South Bay, North Bay). For 2000, workers were then distributed to counties within corridors. It is difficult to be more specific than commute corridors for the long-term future through build-out/2020.

Third, consideration was given to distributing workers in the Downtown & Vicinity expected to reside in San Francisco according to those residing in the Downtown & Vicinity and those residing in the rest of the City. As background for the transportation analysis, workers residing in the rest of the City were then distributed to districts within San Francisco (Southeast, Southwest, Northwest, and Northeast).

The forecasts of the number of workers expected to reside in San Francisco, the commute corridors and the Bay Area counties (for 2000) were evaluated from two perspectives. The first was to consider the percentage distribution of <u>workers</u> among places of residence in light of the analyses of how that distribution appears to be changing. The second perspective was to consider the percentage of employed <u>residents</u> of each place that would be represented by those working in the Downtown & Vicinity. Analyses and forecasts of the future regional context, San Francisco context, and propensities to live in each place and work in the Downtown & Vicinity provided the basis for that evaluation.

The same process was used to develop residence patterns forecasts for each Alternative. The differences in residence patterns between Alternatives arise because of differences in

employment in the Downtown & Vicinity and in the future citywide context for employment and employed population.

The resultant forecasts describe residence patterns likely to occur in the future given job growth and changes in all of the various factors considered. As such the forecasts are likely future outcomes. They do not necessarily identify the workers who might want to live in each county or who might prefer housing of various types or at various locations. Instead, the forecasting process considers how all of the relevant factors throughout the region are likely to combine in producing a particular future result.

Supplemental Tables for Residence Patterns Forecasts

The residence patterns forecasts are presented in the EIR text (see pp. VI.C.55-VI.C.63). Supplemental tables for those forecasts are provided on the following pages. The tables summarize the residence patterns of workers in the Downtown & Vicinity as percentages of jobs in the Downtown & Vicinity (see Tables XIV.C.10 and XIV.C.12) and as percentages of employed residents by place of residence (see Tables XIV.C.11 and XIV.C.13).

Background for Estimates and Forecasts of Places of Work of Residents of the Downtown & Vicinity

This section focuses on estimates and forecasts of places of work of employed persons living in the Downtown & Vicinity including Mission Bay. The perspective here differs from that in the previous section. This section focuses on the places of work of those who live in the Downtown & Vicinity. The previous section focuses on the places of residence of those who work in the Downtown & Vicinity. The analyses done from each of those perspectives are consistent and the estimates and forecasts were prepared using the same background data and future context. They overlap in that the estimated number of residents of the Downtown & Vicinity who also work in the area (developed based on the procedure described in this section) equals the estimated number of workers in the Downtown & Vicinity who also live there (developed based on the procedure outlined in the previous section). Those are two ways of describing the same people.

Estimates of places of work of employed residents of the Downtown & Vicinity were developed for 1980/81 and 1985 based on information from the 1980 Census; the survey of residents of newer housing in the downtown conducted by Recht Hausrath & Associates in 1986 for this EIR (see pp. XIV.C.4-XIV.C.7, for a description of the survey); and 1980 Census data describing commute travel characteristics for residents of the Downtown & Vicinity summarized by Barton-Aschman Associates, Inc. for this EIR. The approach was to develop estimates based on those sources and to compare and refine them using analysis of residence patterns of workers and citywide journey-to-work data from the 1980 Census.

Forecasts of future places of work of residents of the Downtown & Vicinity are consistent with the future context for employment and labor force in San Francisco and the rest of the region. Initially, results of the survey of residents of newer downtown housing were used to estimate places of work for employed residents of new housing to be built in the Downtown & Vicinity in the future. The 1985 distribution for residents of existing housing in the Downtown & Vicinity was assumed to remain constant for future residents of that housing. The two distributions (for residents of new and existing housing) were added together and the combined distribution evaluated and modified considering the overall future context for employment and labor force.

Generally, the forecasts assumed that the propensity of residents of the Downtown & Vicinity to work there will remain high and that the overall, downtown-wide propensity

TABLE XIV.C.10: SUMMARY OF RESIDENCE PATTERNS OF WORKERS IN THE DOWNTOWN & VICINITY AS PERCENTAGES OF JOBS IN THE DOWNTOWN & VICINITY, 1981, 1985 AND 2000

			Scenario for Alternative A	Scenario for Alternative B	Scenario for Alternative N
Place of Residence	1981/a/	1985/a/	2000/a/	2000/a/	2000/a/
San Francisco	55.2	57.6	49.9	50.0	49.8
Downtown & Vicinity	3.3	3.7	4.5	4.6	4.1
Rest of City	51.9	53.9	45.4	45.4	45.7
East Bay	24.9	23.5	29.8	29.7	29.9
Alameda	13.0	12.3	15.7	15.6	15.7
Contra Costa	10.8	10.2	12.5	12.5	12.6
Napa/Solano	1.1	1.0	1.6	1.6	1.6
South Bay	12.6	12.1	12.8	12.8	12.8
San Mateo	11.8	11.3	11.9	11.9	11.9
Santa Clara	0.8	0.8	0.9	0.9	0.9
North Bay	7.2	6.8	7.4	7.4	7.4
Marin	6.4	6.1	6.4	6.4	6.4
Sonoma	0.8	0.7	1.0	1.0	1.0
Other	0.1	small	0.1	0.1	0.1
	100.0%	100.0%	100.0%	100.0%	100.0%

NOTE: This table presents estimates for both 1981 and 1985 for two reasons. One is that 1981 estimates provide the starting point for much of the housing and population analysis because Census data are available for 1980 and the C-3 District Employer/Employee Surveys were done in 1981. The other reason is that the change from 1981 to 1985 is not considered to be typical of long-term trends, so that providing information for both years offers a better basis for comparison when considering forecasts and analyses for future years.

The percentages in the table are derived by dividing the estimate of people working in the Downtown & Vicinity and living in each place by total jobs in the Downtown & Vicinity. The numbers on which the percentages are based are presented elsewhere in the EIR, as identified in the footnotes.

/a/ See Table VI.C.15, p. VI.C.58.

SOURCE: Recht Hausrath & Associates

TABLE XIV.C.11: SUMMARY OF RESIDENCE PATTERNS OF WORKERS IN THE DOWNTOWN & VICINITY AS PERCENTAGES OF EMPLOYED RESIDENTS BY PLACE OF RESIDENCE, 1981, 1985 AND 2000

			Scenario for Alternative A	Scenario for Alternative B	Scenario for Alternative N
Place of Residence	1981/a/	1985/a/	2000/b/	2000/b/	2000/b/
San Francisco	55.8%	52.9%	54.5%	54.0%	54.4%
Downtown & Vicinity	67.6%	65.0%	67.6%	67.6%	67.3%
Rest of City	55.2%	52.2%	53.5%	53.0%	53.5%
East Bay	9.0%	7.3%	8.8%	8.7%	8.7%
Alameda	8.7%	7.2%	9.2%	9.1%	9.2%
Contra Costa	12.2%	9.9%	11.4%	11.3%	11.4%
Napa/Solano	2.9%	2.1%	2.7%	2.7%	2.7%
South Bay	4.5%	3.8%	4.3%	4.2%	4.2%
San Mateo	13.1%	11.6%	13.2%	13.4%	13.5%
Santa Clara	0.4%	0.4%	0.4%	0.4%	0.4%
North Bay	10.1%	8.2%	8.8%	8.7%	8.7%
Marin	18.9%	16.4%	19.3%	19.0%	19.2%
Sonoma	2.1%	1.6%	2.0%	2.0%	2.0%
Other	NA	NA	NA	NA	NA
TOTAL BAY AREA REGION	13.7%	12.0%	12.2%	12.1%	12.2%

NA - Not applicable.

NOTE: This table presents estimates for both 1981 and 1985 for two reasons. One is that 1981 estimates provide the starting point for much of the housing and population analysis because Census data are available for 1980 and the C-3 District Employer/Employee Surveys were done in 1981. The other reason is that the change from 1981 to 1985 is not considered to be typical of long-term trends, so that providing information for both years offers a better basis for comparison when considering forecasts and analyses for future years.

The percentages in the table are derived by dividing the estimate of people working in the Downtown & Vicinity and living in each place by total workers living there (employed population). The numbers on which the percentages are based are presented elsewhere in the EIR, as identified in the footnotes.

/a/ See Table VI.C.6, p. VI.C.30, Table VI.C.7, p. VI.C.33, and Table VI.C.3, p. VI.C.12.
/b/ See Table VI.C.9, p. VI.C.39, Table VI.C.10, p. VI.C.45 and Table VI.C.15, p. VI.C.58.

SOURCE: Recht Hausrath & Associates

TABLE XIV.C.12: SUMMARY OF RESIDENCE PATTERNS OF WORKERS IN THE DOWNTOWN & VICINITY AS PERCENTAGES OF JOBS IN THE DOWNTOWN & VICINITY, 1981, 1985, 2000, AND BUILD-OUT/2020

			Scenario for Alternative A		Scenario for Alternative B		Scenario for Alternative N	
Place of Residence	1981/a/	1985/a/	2000/a/	2020/b/	2000/a/	2020/b/	2000/a/	2020/b/
San Francisco	55.2	57.6	49.9	48.7	50.0	49.8	49.8	48.5
Downtown & Vicinity	3.3	3.7	4.5	5.5	4.6	6.0	4.1	4.3
Rest of City	51.9	53.9	45.4	43.2	45.4	43.8	45.7	44.2
East Bay	24.9	23.5	29.8	29.8	29.7	29.7	29.9	29.9
South Bay	12.6	12.1	12.8	13.5	12.8	12.9	12.8	13.6
North Bay	7.2	6.8	7.4	7.8	7.4	7.5	7.4	7.8
Other	0.1	small	0.1	0.2	0.1	0.1	0.1	0.2
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

NOTE: This table presents estimates for both 1981 and 1985 for two reasons. One is that 1981 estimates provide the starting point for much of the housing and population analysis because Census data are available for 1980 and the C-3 District Employer/Employee Surveys were done in 1981. The other reason is that the change from 1981 to 1985 is not considered to be typical of long-term trends, so that providing information for both years offers a better basis for comparison when considering forecasts and analyses for future years.

The percentages in the table are derived by dividing the estimate of people working in the Downtown & Vicinity and living in each place by total jobs in the Downtown & Vicinity. The numbers on which the percentages are based are presented elsewhere in the EIR, as identified in the footnotes.

/a/ See Table VI.C.15, p. VI.C.58.
/b/ See Table VI.C.16, p. VI.C.61.

SOURCE: Recht Hausrath & Associates

TABLE XIV.C.13: SUMMARY OF RESIDENCE PATTERNS OF WORKERS IN THE DOWNTOWN & VICINITY AS PERCENTAGES OF EMPLOYED RESIDENTS OF CORRIDORS OF THE REGION, 1981, 1985, 2000, AND BUILD-OUT/2020

			Scenario for Alternative A		Scenario for Alternative B		Scenario for Alternative N	
Place of Residence	1981/a/	1985/a/	2000/b/	2020/c/	2000/b/	2020/c/	2000/b/	2020/c/
San Francisco	55.8%	52.9%	54.5%	57.2%	54.0%	56.4%	54.4%	57.4%
Downtown & Vicinity	67.6%	65.0%	67.6%	69.0%	67.6%	68.8%	67.3%	67.9%
Rest of City	55.2%	52.2%	53.5%	56.0%	53.0%	55.0%	53.5%	56.6%
East Bay	9.0%	7.3%	8.8%	8.7%	8.7%	8.4%	8.7%	8.7%
South Bay	4.5%	3.8%	4.3%	4.6%	4.2%	4.3%	4.2%	4.6%
North Bay	10.1%	8.2%	8.8%	9.1%	8.7%	8.5%	8.7%	9.1%
TOTAL BAY AREA REGION	13.7%	12.0%	12.2%	12.4%	12.1%	12.0%	12.2%	12.3%

NOTE: This table presents estimates for both 1981 and 1985 for two reasons. One is that 1981 estimates provide the starting point for much of the housing and population analysis because Census data are available for 1980 and the C-3 District Employer/Employee Surveys were done in 1981. The other reason is that the change from 1981 to 1985 is not considered to be typical of long-term trends, so that providing information for both years offers a better basis for comparison when considering forecasts and analyses for future years.

The percentages in the table are derived by dividing the estimate of people working in the Downtown & Vicinity and living in each place by total workers living there (employed population). The numbers on which the percentages are based are presented elsewhere in the EIR, as identified in the footnotes.

/a/ See Table VI.C.6, p. VI.C.30, Table VI.C.7, p. VI.C.33, and Table VI.C.3, p. VI.C.12.
/b/ See Table VI.C.9, p. VI.C.39, Table VI.C.10, p. VI.C.45, and Table VI.C.15, p. VI.C.58.
/c/ See Table VI.C.11, p. VI.C.47, Table VI.C.12, p. VI.C.50, and Table VI.C.16, p. VI.C.61.

SOURCE: Recht Hausrath & Associates

for people to both live and work in the Downtown & Vicinity will increase as new housing is built there. Comparison of the survey responses of residents of newer downtown housing to 1980 Census data indicated a higher propensity to work downtown among those residing in new housing as compared to residents of older, existing units in the area.

Table XIV.C.14 presents the forecasts of places of work of employed residents of the Downtown & Vicinity. They supplement the summary discussion in the EIR text (see p. VI.C.63).

<u>Background for Consideration of the Relationship Between Project Area Employment Growth and Housing Development</u>

This section provides background for two aspects of the overall jobs/housing evaluation presented in the Impact section (see pp. VI.C.67-VI.C.81). First, it provides background on estimates of additional housing units needed to accommodate additional San Francisco households with Project Area workers for each of the Alternatives. Those estimates provide a measure of the demand for additional housing in San Francisco associated with Project Area employment growth. In the Impact section, the estimates of additional housing units are compared to the supply of new units to be provided by Project Area housing development (see Table VI.C.18, p. VI.C.72).

Second, this section provides background for consideration of housing affordability as related to household incomes of San Francisco households with Project Area workers and to housing prices their incomes would support. In the Impact section, those housing prices are compared to estimated price ranges for units to be built in Mission Bay to provide information about how the Alternatives could affect the City's housing market (see Table VI.C.19, p. VI.C.73).

For both considerations, the analyses followed an approach similar to that used to develop the economic basis for the City's Office Affordable Housing Production Program (OAHPP)./11/

Background for Estimates of Additional San Francisco Households and Housing Units Associated with Project Area Employment Growth

The estimates are derived from the cumulative analyses and forecasts prepared to define the future context for this EIR. The relationships established by those cumulative analyses and forecasts were used to develop ratios and factors to isolate the contributions of Mission Bay to employment growth and housing development. In other words, ratios and factors developed from the cumulative analyses were used to compare and evaluate the employment growth and housing development the Alternatives would contribute to future citywide conditions. As a check on the approach, similar ratios and factors also were applied to downtown growth generally and to other growth in the City to test the reasonableness of the results (i.e., that additional households associated with employment growth compared reasonably with additional households and housing forecast for the City, accounting for households without workers as well).

The relationships used to develop estimates of additional San Francisco households with Project Area workers are derived from the cumulative future context over the entire analysis period through build-out/2020. Because of the availability of Census data for 1980 and downtown survey data for 1981, ratios of changes over time reflect forecasts from 1980/81 through 2020.

Table XIV.C.15 provides background on calculating estimates of additional housing units to accommodate additional San Francisco households associated with Project Area

TABLE XIV.C.14: PLACES OF WORK FOR EMPLOYED RESIDENTS OF THE DOWNTOWN & VICINITY, 1980-1981, 1985, 2000, AND BUILD-OUT/2020

			Scenario for Alternative A		Scenario for Alternative B		Scenario for Alternative N	
	1980-1981	1985	2000	2020	2000	2020	2000	2020
Number of Residents of the Downtown & Vicinity by Place of Work								
Downtown & Vicinity	11,230	12,500	20,180	27,600	20,180	29,300	18,020	21,200
Rest of San Francisco	3,730	4,140	5,520	7,200	5,520	7,700	5,000	5,800
Total San Francisco	14,960	16,640	25,700	34,800	25,700	37,000	23,020	27,000
Rest of Region and Outside of Region	1,645	2,580	4,150	5,200	4,150	5,600	3,750	4,200
TOTAL	16,605	19,220	29,850	40,000	29,850	42,600	26,770	31,200
Percent Distribution of Residents of the Downtown & Vicinity by Place of Work								
Downtown & Vicinity	67.6	65.0	67.6	69.0	67.6	68.7	67.3	68.1
Rest of San Francisco	22.5	21.5	18.5	18.0	18.5	18.2	18.7	18.4
Total San Francisco	90.1	86.5	86.1	87.0	86.1	86.9	86.0	86.5
Rest of Region and Outside of Region	9.9	13.5	13.9	13.0	13.9	13.1	14.0	13.5
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

NOTE: The future places of work for residents of the Downtown & Vicinity were estimated based on cumulative analysis of employment and employed residents in San Francisco and the rest of the region and the results of the Downtown Residents Survey conducted in 1986 (see pp. XIV.C.4-XIV.C.7). It is assumed that the high propensity of employed downtown residents to work downtown that existed in 1985-1986 would continue to apply for residents of new housing built downtown in the future.

SOURCE: Recht Hausrath & Associates

TABLE XIV.C.15: BACKGROUND FOR ESTIMATING THE ADDITIONAL SAN FRANCISCO HOUSING ASSOCIATED WITH PROJECT AREA EMPLOYMENT GROWTH

	Alternative A	Alternative B	Alternative N
Additional Employment Accommodated by Project Area Development, 1986 – Build-out/2020	22,980	4,230	15,250
Steps in the Calculations:/a/			
1. Percent representing additional workers residing in San Francisco	34.4%	36.7%	33.2%
2. Percent of above representing additional households in San Francisco	60%	62%	57%
3. Average number of San Francisco workers in City households with workers employed in the Downtown & Vicinity	1.40	1.39	1.42
Result of Steps 1, 2 and 3:			
Additional Households Associated with Employment Growth	3,388	692	2,032
4. Average housing vacancy for comparison with housing development in Mission Bay	3.5%	3.5%	3.5%
Additional Housing Units to Accommodate Additional San Francisco Households with Project Area Workers/b/	3,511	718	2,106

NOTE: This table provides background for the discussion of the overall relationship between Project Area employment growth and housing development presented in VI.C. Housing and Population, pp. VI.C.67–VI.C.81, and particularly Table VI.C.18, p. VI.C.72.

/a/ Background for each of these steps is presented in the appendix text.
/b/ These estimates are derived by the following calculations:

$$\text{Additional Project Area Employment} \times \%\text{ in Step 1} \times \%\text{ in Step 2} \div \text{ratio in Step 3} \div 96.5\%\text{ occupancy from Step 4}$$

SOURCE: Recht Hausrath & Associates

employment growth. The ratios and factors applied at each step in the calculations are identified. Explanation of each step follows.

Step 1: Additional Workers Residing in San Francisco

Not all additional workers employed in the Project Area would live in San Francisco. Thus, not all additional employment can be associated with demand for San Francisco housing. The forecasts for the Downtown & Vicinity (including Mission Bay) were used to develop a ratio of the increase in workers residing in San Francisco to the growth of employment in the Downtown & Vicinity (see Table XIV.C.16). That ratio can be used to relate increments of employment growth (such as that in Mission Bay) to increases in workers residing in San Francisco. It is used in Step 1.

The percent of employment growth represented by the increase in workers living in San Francisco (shown in Table XIV.C.16) is lower than the average percentage of total employment in the Downtown & Vicinity represented by all those residing in the City. That is because future labor force and housing growth in San Francisco are not expected to increase in proportion to employment growth. Further, labor force and housing elsewhere in the region are forecast to increase by larger amounts than in San Francisco. For example, with Alternative A, the percentage of total employment in the Downtown & Vicinity represented by those living in the City is expected to decline from an average of 55.2% in 1981 to 49.9% in 2020 (see Table XIV.C.12, p. XIV.C.27). For this scenario, the growth of workers in the Downtown & Vicinity who would live in the City as a percentage of the growth of jobs would be 34.4% (see Table XIV.C.16). The latter ratio is used in the calculations in Table XIV.C.15 because the purpose is to estimate the share of job growth accommodated in Mission Bay that would represent an increase in workers residing in San Francisco. Differences between Alternatives in the ratio reflect different cumulative scenarios of employment growth and growth of employed residents.

Step 2: Those Accommodated in Additional Households in the City

Not all additional workers expected to reside in San Francisco would be in additional households competing for additional housing units. The reason is that the average number of workers per household in the future is forecast to increase resulting in changes in occupancy of existing housing stock. Such changes would account for some of the additional workers, reducing the demand for additional housing.

The percentages shown for Step 2 in Table XIV.C.15 (p. XIV.C.31) are derived from forecasts of future housing and employed population in San Francisco (presented for 1980 in Table VI.C.3, p. VI.C.12 and for the future in Table VI.C.11, p. VI.C.47). Forecasts of growth of employed population in the City include growth attributable to increases in the number of households and housing units in the City and growth contributed by increases in the average number of workers per household for those occupying the existing number of units. The ratios in Step 2 represent the increase in employed population provided by additional households and housing units in the City as a percentage of the total increase in employed population. For example, with Alternative A, about 60% of the growth of employed population in the City would be persons in additional households. (The remaining 40% would represent additional workers accommodated in the existing housing stock through increases in the average number of workers per household.) Differences between Alternatives in the ratio primarily reflect different citywide scenarios for housing development.

The Step 2 ratios are calculated for the entire analysis period (1980 - build-out/2020). They combine the forecast that the average number of workers per household in

TABLE XIV.C.16: BACKGROUND FOR STEP 1: COMPARISON OF FORECASTS OF EMPLOYMENT GROWTH IN THE DOWNTOWN & VICINITY TO INCREASE IN WORKERS IN THE DOWNTOWN & VICINITY AND RESIDING IN SAN FRANCISCO

	Scenario for Alternative A	Scenario for Alternative B	Scenario for Alternative N
Increase in Employment in the Downtown & Vicinity, 1981 - Build-out/2020/a/	157,920	143,020	153,520
Increase in People Working in the Downtown & Vicinity and Residing in San Francisco, 1981 - Build-out/2020/a/	54,420	52,520	51,020
Increase in People Working in the Downtown & Vicinity and Residing in San Francisco, as a Percent of Increase in Employment in the Downtown & Vicinity	34.4%	36.7%	33.2%

/a/ The increases shown here can be calculated from the numbers for 1981 presented in Table VI.C.15, p. VI.C.58, and for 2020 in Table VI.C.16, p. VI.C.61.

SOURCE: Recht Hausrath & Associates

San Francisco will increase from 1980 through 2000 and the forecast that that ratio will stabilize through 2020 because of the aging of the population, as discussed in the description of the future context for housing and population (see pp. VI.C.38-VI.C.51).

This step is included in the calculations because not all of the additional workers residing in San Francisco would contribute demand for additional housing. Some of the additional workers would reside in the existing housing stock. Increases in workers-per-household will occur for many reasons, resulting in more workers living in the City without adding housing units. For example, increases in workers-per-household reflect higher labor force participation (more women work, a larger percentage of the population in their labor force years) and stronger preferences among working adults for living in San Francisco. Increases in workers-per-household also reflect lifestyle preferences (more unrelated individuals in their labor years living together), adaptations to housing costs (more workers living together for housing affordability reasons), and other factors (cultural or ethnic factors supporting extended families or multi-family households). Of all of those types of changes, most are not attributable to employment growth. They reflect broad demographic, socio-economic, lifestyle, housing market, and other factors. Some of the changes, however, can be related to employment growth. For example, upward pressure on housing prices/rents because of employment growth could contribute to increasing workers-per-household. The effects of employment growth cannot be separately identified, however. Further, changes in behavior cannot always be related to only one reason and may reflect a combination of factors.

Step 3: Estimating the Number of Additional Households

The next step is to convert the additional workers to be accommodated by household growth into an estimate of the number of households they would represent. As shown in Table XIV.C.15 (p. XIV.C.31), the future average number of San Francisco workers in San Francisco households with workers employed in the Downtown & Vicinity is the factor used for the conversions. This step in the calculations is needed because, on average, households with workers employed in the Downtown & Vicinity have more than one worker employed in the City.

The factor developed for each Alternative is derived from the 1981 C-3 District and 1982 South of Market//Folsom Employer and Employee Surveys and 1980 Census data. Per-household factors were developed for the major business activities and then applied to the activities in Mission Bay under each Alternative. Thus differences between Alternatives in the factors reflect the different business activities in each.

The per-household factors for the Step 3 calculation represent expected future conditions and reflect values similar to 1980/81 conditions. It is reasonable to expect similar conditions over time since expected changes have offsetting effects. First, the average number of workers per household across all City households is expected to increase. Most likely, workers-per-household for households with workers employed in the Downtown & Vicinity (as a subgroup of all City households) also will increase, possibly by a smaller amount [since increases in the citywide average that applies to all households (both those with and those without workers) may reflect an increase in the percentage of households that have workers as well as an increase in workers-per-household in households with workers]. Second, the proportion of the City's employed population that works outside of San Francisco is expected to increase relative to those working in the City. Thus, the number of San Francisco workers per household is expected to decline in the future because of that trend.

Result of Steps 1, 2 and 3

Applying the ratios and factors in Steps 1, 2 and 3 results in estimates of additional San Francisco households associated with employment growth in each Alternative.

Step 4: Estimating the Number of Additional Housing Units

For each Alternative, the number of additional households in the City that have Project Area workers is compared to the number of housing units added in the Project Area. For comparability, the estimates of additional households are converted into estimates of additional housing units, accounting for housing vacancy. A 3.5% vacancy is assumed because 3.5% of the units to be built in Mission Bay are assumed to be vacant, on average.

Background for Consideration of Housing Affordability

In addition to the number of additional San Francisco households associated with Project Area employment growth, incomes of those households and the housing prices their incomes would support also were considered.

Estimates of Household Incomes. The estimates of household incomes for additional San Francisco households with Project Area workers are very approximate and based on simplified assumptions. It is assumed that, in constant 1984 dollars, household income distributions would be similar to 1984 income distributions for San Francisco households with workers employed in the Downtown & Vicinity in similar types of jobs. The estimated household income distributions derived for San Francisco households with Project Area workers are presented in Table XIV.C.17.

TABLE XIV.C.17: ESTIMATED HOUSEHOLD INCOME DISTRIBUTIONS FOR SAN FRANCISCO HOUSEHOLDS WITH PROJECT AREA WORKERS

Household Income (1984 Dollars)	Percent Distributions Alternative A	Alternative B	Alternative N
Less than $15,000	16.6	17.6	16.4
$15,000-24,999	24.0	26.0	21.4
$25,000-49,999	38.2	37.2	41.2
$50,000-74,999	15.3	14.0	15.8
$75,000-99,999	4.0	3.5	4.1
$100,000 and above	1.9	1.7	1.1
TOTAL	100.0%	100.0%	100.0%

NOTE: Data on household income distributions are from 1981 C-3 District and 1982 South of Market/Folsom Employer and Employee Surveys, updated to 1984 dollars. The year 1984 is used for comparability with housing price assumptions for Mission Bay from the Mayor's Letter.

SOURCE: Recht Hausrath & Associates

Data on household incomes of households with workers employed in the Downtown & Vicinity are from the 1981 C-3 District and 1982 South of Market/Folsom Employer and Employee Surveys, updated to 1984 dollars. The year 1984 was used for comparability with housing price assumptions for Mission Bay from the Mayor's Letter. Survey data on household incomes were compiled for the major different business activities in the Downtown & Vicinity and then applied to the business activities in Mission Bay under each Alternative. The resultant household income distributions vary between Alternatives because of differences in the business activities in each.

- The household income distributions are derived from survey data for all households with workers employed in the Downtown & Vicinity and living in the City, including those in new housing and those in older units. The income distributions are appropriate for considering the varying abilities of worker-households to pay for housing. Such consideration is an aspect of the assessment of how the Alternatives could affect the City's housing market. It also is useful in considering options for affordable housing in Mission Bay.

The household income information should not be used to evaluate housing prices of new units built in the Project Area by "matching" them with the housing prices supported by household incomes of Project Area workers. That is because it is not possible to provide

new housing in San Francisco for all income groups without large subsidies at the lower end of the range. Comparisons of incomes and housing prices should be assessed within a broader market context (since the difficulties of producing new housing at affordable prices/ rents for a large segment of the population exist throughout the region and nation), and consideration should be given to what is feasible as well as desirable.

Consideration of Ability to Pay for Housing Based on Household Income. It is difficult to estimate accurately housing prices and rents that households can afford to pay because the prices and rents vary by household size, equity in a previous home and a variety of individual circumstances. However, generalized assumptions were made for purposes of assessing the housing market implications of the Alternatives. Table XIV.C.18 summarizes the approximate housing prices and rents affordable to households in the various household income categories. The assumptions are noted in the table. The table also indicates how the household income categories compare with U.S. Department of Housing and Urban Development (HUD) income categories used for housing subsidy programs. The HUD categories group households according to how their incomes compare with median incomes for the local area.

For considering how resources available for housing might compare with prices of new units in the Project Area the number of households and housing units are divided into two groups: "affordable" and "other." Worker households with incomes below $50,000 were grouped as those who would seek "affordable" housing. Those with incomes above $50,000 were grouped as those who would seek "other" housing. For categorizing the supply of units to be built in Mission Bay, what is called "affordable" new housing includes units with prices assumed to range from $105,000 to $150,000 and average $125,000 in 1984 dollars (per Mayor's Letter). The lowest-priced units would still be more costly than many of the households seeking affordable housing could afford. The implications for the housing market were considered and are described in the impact chapter (see pp. VI.C.81-VI.C.88).

TABLE XIV.C.18: CONSIDERATION OF ABILITY TO PAY FOR HOUSING BASED ON HOUSEHOLD INCOME

Household Income Category	Approximate Affordability Category/a/	Approximate Housing Price Supported by Household Income/b/	Approximate Monthly Rent Supported by Household Income/c/
Less than $15,000	Very low income (about 50% of median income)	Less than $35,000	Less than $375
$15,000-$24,999	Low income (50%-80% of median income)	$35,000-$66,000	$375-625
$25,000-$49,999	Moderate and middle income (80%-165% of median income)	$66,000-$144,000	$625-$1,250
$50,000-$74,999	NA	$144,000-$222,000	$1,250-$1,875
$75,000-$99,999	NA	$222,000-$300,000	$1,875-$2,500
$100,000 and above	NA	Above $300,000	Above $2,500

NA - Not applicable.

NOTE: These estimates are very approximate and were prepared as input into the assessment of how the Alternatives could affect the City's housing market.

/a/ This column identifies how the household income categories compare with categories used in federal housing subsidy programs by the U.S. Department of Housing and Urban Development (HUD). The HUD categories group households according to how their incomes compare with median incomes for the local area. For the additional worker households, median income for households averaging 2.2 persons per household was assumed. The categorization is only approximate since the household income categories do not correspond exactly to the HUD categories.

/b/ For purposes of estimating the house price to be supported by household incomes in the various categories, it was assumed that 33% of gross income could be allocated for mortgage principal and interest, property taxes, fire insurance, and homeowner association dues. To calculate the house price supported by this share of income, the following were assumed: 30-year mortgage at 10% interest, 10% down payment, property taxes at 1.25% of price, and fire insurance and homeowner association dues at $1,200 per year. It is possible that households with lower incomes could afford higher prices than calculated here if mortgage revenue bond financing were available. Households with higher incomes could afford higher prices if larger downpayments than assumed were available. The estimates shown are very approximate.

/c/ For rental housing, it is assumed that households could pay 30% of their gross income for rent.

SOURCE: Recht Hausrath & Associates

NOTES - Housing and Population

/1/ U.S. Department of Commerce, 1970 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Vallejo-Napa SMSA, Santa Rosa SMSA, and San Jose SMSA, Table H-1, and 1980 Census of Population and Housing: Census Tracts, San Francisco-Oakland SMSA, Vallejo-Fairfield-Napa SMSA, Santa Rosa SMSA, and San Jose SMSA, Table H-1.

/2/ Construction Industry Research Board, "New Housing Units in Building Permits Issued, 1977-86: California and Metropolitan Areas," February 1987.

/3/ Federal Home Loan Bank of San Francisco, Housing Vacancy Surveys for Bay Area Counties, Survey Dates July and September 1985, Publication Dates August, September and October 1985, February and March 1986; Survey Dates July and September 1986, Publication Dates November 1986, January, March and May 1987.

/4/ Bay Area Council, Bay Area Housing Briefs, Volume 6, Number 5, May 1987.

/5/ Real Estate Research Council of Northern California, Market Trend - October 1986, Single Family Residences, Volume 38, Number 2, February 1987.

/6/ San Francisco Department of City Planning, Housing Information Series: Changes in the San Francisco Housing Inventory, reports for 1980 (1981), 1981-1982 (September 1983), 1983-1984 (July 1985), and 1985 (August 1986).

/7/ The part of census tract 607 that is not in the Project Area technically is part of the nearby residential areas. The total population in tract 607 is small, according to the 1980 Census (44 people in 27 households). Subtracting the survey estimate of Mission Bay Project Area residents leaves ten people and eight households for the rest of census tract 607. These could be people living in the North Potrero area at the foot of Potrero Hill. The Census data might represent the shantytown dwellers who until early 1986 resided on public land west of the China Basin Channel just outside the Project Area near the intersection of Seventh and Berry Streets. This small group is not specifically accounted for in the Nearby Areas tables or text.

/8/ The DOF estimate of housing units was used because it is developed based on a methodology that relates total housing units, occupied housing units (households), average household size, and population as estimated from several sources. The approach incorporates estimates of new housing construction and demolitions since the 1980 Census as well as estimates of additional households from data on residential electric customers. It evaluates the estimates of households and housing units within the context of population estimates from a variety of sources including school enrollment, auto registration, and voter registration. The benefit of this approach is that it focuses on changes in occupied housing units or households and provides the ability to identify changes in addition to those accounted for by reported new construction and demolitions including the addition of illegal secondary units and changes in occupancy of existing stock.

/9/ The ABAG forecasts can be disaggregated for subareas of the City for comparison to the Mission Bay EIR forecasts for the Downtown & Vicinity and the rest of the City. At the time the economic analysis for the Mission Bay EIR was done, Projections '85 was the only set of ABAG forecasts available in a form enabling such disaggregation. Grouping Projections '85 forecasts for San Francisco by census tract into an area that approximates the Downtown & Vicinity results in numbers that can be compared to the 1986-2000 forecasts prepared for the Mission Bay EIR.

As noted above and shown in Table XIV.C.8, p. XIV.C.18, Projections '85 shows a decline in San Francisco population from 1986 through 2000, while the Mission Bay EIR forecasts, DOF forecasts, and updated ABAG forecasts (Projections '87) show population growth. This basic difference is apparent in comparison of the disaggregated forecasts. The population forecasts for the Downtown & Vicinity are relatively similar. The Mission Bay EIR forecasts for the Downtown & Vicinity show population growth ranging from 11,000 to 16,300, depending on the Alternative (see Table VI.C.9, p. VI.C.39). Projections '85 disaggregated for a comparable area shows population growth of about 16,500. The major difference is in the forecasts for the rest of the City. The Mission Bay EIR forecasts show population growth of about 30,000, while Projections '85 shows population decline of about 23,000. Since ABAG has updated the San Francisco forecasts in Projections '87 and the totals for the City are more similar to the Mission Bay EIR forecasts, disaggregating Projections '87 would show that ABAG's revised forecasts for the rest of the City now indicate population growth along the lines forecast for the Mission Bay EIR.

/10/ 1980 Census journey-to-work data were reviewed as tabulated on a county-to-county basis and for smaller areas within San Francisco as tabulated by the Metropolitan Transportation Commission and Barton-Aschman Associates, Inc. using MTC data. See U.S. Department of Commerce, 1980 Census of Population: Journey-to-Work: Metropolitan Commuting Flows, Table 3, and Metropolitan Transportation Commission, "1980 Census Journey-to-Work: County-to-County and Superdistrict-to-Superdistrict Workers by Mode of Travel, Data Release #2," July 1984, revised September 5, 1984.

/11/ Recht Hausrath & Associates, "Summary of the Economic Basis for an Office-Housing Production Program," July 19, 1984. The report, prepared for the Department of City Planning, summarizes the relationship between employment growth and the housing market and the approach used to develop the economic rationale for the OAHPP.

APPENDIX D. COMMUNITY SERVICES AND INFRASTRUCTURE

FIRE PROTECTION

TABLE XIV.D.1: REPORTED INCIDENTS, SAN FRANCISCO CITYWIDE, FY 1985-1986

Type of Incident	Number of Incidents
Telephone Alarms	
False Alarms	3,813
Actual Incidents	30,582
TOTAL	34,395
Street Box Alarms	
False Alarms	6,324
Actual Incidents	1,950
TOTAL	8,274
TOTAL NUMBER OF ACTUAL INCIDENTS	32,532
Greater Alarms	
Second Alarms	55
Third Alarms	11
Fourth Alarms	1
Fifth Alarms	2
TOTAL	69

SOURCE: San Francisco Fire Department, Annual Report, 1985-1986, p. 18, and Environmental Science Associates, Inc.

TABLE XIV.D.2: FIRE DEPARTMENT INCIDENTS CITYWIDE, 1977-1986

Fiscal Year	Fire Incidents/a/	Non-Fire Incidents/a/
1977-1978	7,582 (33%)	15,627 (67%)
1978-1979	8,470 (33%)	17,065 (67%)
1979-1980	8,354 (32%)	17,931 (68%)
1980-1981	8,080 (30%)	18,561 (70%)
1981-1982	6,584 (26%)	18,483 (74%)
1982-1983	6,116 (25%)	18,684 (75%)
1983-1984	6,356 (25%)	19,564 (75%)
1984-1985	7,132 (25%)	21,514 (75%)
1985-1986	6,709 (21%)	26,075 (79%)

/a/ Percent of fire and non-fire incidents equals 100% for each fiscal year.

SOURCE: San Francisco Fire Department, Annual Report, 1981-1982, 1985-1986, and Environmental Science Associates, Inc.

TABLE XIV.D.3: MONTHLY HOURS OUT-OF-SERVICE - BATTALION 3 DISTRICT, FY 1985-1986/a/

	1985	1986	Capacity/b/
Engine Company 1	440.9	571.3	672.0
Engine Company 8	272.6	267.7	672.0
Engine Company 35	232.2	219.8	672.0
Truck Company 1	421.3	517.9	610.0
Truck Company 8	196.8	201.0	610.0
Rescue Squad 1	553.6	533.8	628.0
Fireboat Company 1	59.1	50.2	NA
Battalion 3	364.4	340.5	400.0

NA - Not applicable.

/a/ "Out-of-service" is a unit responding to a call and unavailable to respond to other incidents.
/b/ Total number of out-of-service hours theoretically available.

SOURCE: Oliver Storti, Assistant Chief, Management Services, San Francisco Fire Department, memorandum, February 4, 1987, and Environmental Science Associates, Inc.

TABLE XIV.D.4: HAZARDOUS MATERIALS INCIDENTS, CITYWIDE AND BATTALION 3 DISTRICT, FY 1985-1986

Citywide

Source	Number
Unknown	25
Explosives	12
Compressed Gas Leak	128
Flammable Liquid Spill/Leak	75
Flammable Solids	2
Oxidizing/Organic Peroxides	2
Poisons	5
Radioactive Material	0
Corrosives	9
Other Regulated Material	47
TOTAL	305

Battalion 3 District/a/

Date	Address	Hazardous Material
February 8, 1985	380 10th Street	Unknown substance
April 22, 1985	510 Townsend Street	55-gallon drum of solvent
April 2, 1986	880 Bryant Street	Unknown substance
July 26, 1986	701 Third Street	Storage container abandoned
July 26, 1986	425 Second Street	Fuel spill
August 29, 1986	Townsend between Seventh and Eighth	Three 55-gallon drums of oil

/a/ None occurred in the Mission Bay Project Area.

SOURCE: San Francisco Fire Department, Annual Report, 1985-1986; Oliver Storti, Assistant Chief, Management Services, San Francisco Fire Department, memorandum, February 4, 1987; and Environmental Science Associates, Inc.

METHOD FOR CALCULATION OF DEMAND FOR FIRE PROTECTION SERVICES

Summary of Method

This section discusses the data and methodology used to project the demand for Fire Department personnel needed to maintain the current level of fire protection in the Mission Bay Project Area for 2000 and 2020. The staffing demands were calculated for each of the EIR Alternatives using a five-step procedure. First, based on fire/and non-fire incident by land use and the projected land use characteristics of each Alternative, the number of incidents in the Project Area was projected for the years 2000 and 2020. Next, the average time required to service a fire and non-fire incident for each land use category was determined based on 1984-1986 Fire Department data. The projected number of incidents was then multiplied by the appropriate service time, forming projections for fire service demands in terms of service time. Based on the average service time provided by engine and truck companies, the demand for additional fire service units was estimated for 2000 and 2020. Finally, the number of Fire Department personnel required to staff these units, conduct building inspections, and provide managerial and support services was estimated based on new commercial square footage. The addition of an engine company would be required by 2000 under Alternatives A and B. By 2020 both an additional engine and truck company would be required for Alternatives A and B. Alternative N would not require an additional company. Fifteen additional firefighters would be required by the year 2000 under Alternatives A and B. By 2020 the projected personnel increases are 36 for Alternative A, 35 for Alternative B and 11 for Alternative N. Calculations are discussed on pp. XIV.D.4-XIV.D.11 below, and Tables XIV.D.5-XIV.D.12.

Fire/Non-Fire Incidents

Fire/non-fire incidents (referred to as incidents) as reported by the San Francisco Fire Department are quantitative in nature and recorded in a manner that the number and types of incidents may be associated with different land uses. To estimate fire/non-fire incidents in Mission Bay, a sample of buildings and land areas encompassing the 13 land use categories in Mission Bay was designed by ESA, assisted by the Department of City Planning, to consist largely of recently constructed buildings on the premise that such a sample would more accurately reflect the types of structural characteristics anticipated for Mission Bay development./1/ New buildings built in compliance with the more recent Life Safety Provisions of the San Francisco Building Code while many older buildings do not comply with present codes. As a result, the newer structures generate fewer fire incidents per square foot. Tables XIV.D.14 and XIV.D.15, pp. XIV.D.13 and XIV.D.16, list sample addresses and total gross square footage, acreage or number of units for each land use category.

The San Francisco Fire Department allowed ESA access to computer print-outs of fire incidents by date, type of incident and address./2/ ESA compiled, by type, all incidents reported at the sample addresses during the years 1984, 1985 and 1986. This information was matched with the land use sample to develop ratios of the number of incidents (a) per dwelling units for privately owned, rental, "affordable" and senior housing and hotel units, (b) per thousand gross square feet of building space for office, S/LI/RD, retail and community facilities, and (c) per acre for parks/open spaces. These ratios are presented in Table XIV.D.5.

The incident/land use ratios were then multiplied by the projected land use characteristics of each Alternative (see Tables V.1, V.2, and V.3, pp. V.8, V.9, and V.20, for projected land use characteristics) for the analysis years 2000 and 2020 (Build-out) to

TABLE XIV.D.5: REPORTED FIRE/NON-FIRE INCIDENTS ASSOCIATED WITH LAND USE CATEGORIES IN SAN FRANCISCO, 1984-1986

Land Use	Incidents 1984-1986	Land Use Units/a/	Annual Incident Ratio/b/
Owner-Occupied Housing	106	564 du	0.0626/du
Rental Housing	101	721 du	0.0467/du
Affordable Housing	30	73 du	0.1370/du
Senior Housing	99	863 du	0.0382/du
Hotel	188	3,144 rooms	0.0199/room
Office	99	2,230 kgsf	0.0148/kgsf
S/LI/RD	87	1,116 kgsf	0.0260/kgsf
Retail	289	924 kgsf	0.1043/kgsf
Community Facilities	116	584 kgsf	0.0662/kgsf
Park/Open Space	11	50 acres	0.0733/acre
M-2 East of Third St.	18	411 kgsf	0.0146/kgsf
M-2 West of Third St.	2	1,112 kgsf	0.0006/kgsf

du - Dwelling units.
kgsf - Thousand gross square feet.

/a/ Total number of land use units in sample.
/b/ The incident ratio is the annual number of fire/non-fire incidents per land use unit. [(1984-1986) Incidents/3 years) / Land Use Units] = Annual Incident Ratio. The ratio is based on incidents reported.

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

project the number of incidents./1,3/ The projected numbers of incidents for the year 2000 are 310 for Alternative A, 244 for Alternative B and 41 for Alternative N. For the year 2020 the numbers of incidents are 771 for Alternative A, 819 for Alternative B and 118 for Alternative N (see Table XIV.D.6).

Out-of-Service Time

The number of incidents may not provide the best picture of the demand for fire protection services. The following factors should also be considered: a) different types of incidents require different amounts of service time, b) different types of service units spend different amounts of time at similar incidents, and c) some incidents are responded to by several units while others are responded to by only one unit. Measuring demand by time out-of-service incorporates these factors.

To convert the projected number of incidents into a projection of the amount of time out-of-service (referred to hereafter as service time) incidents were first classified according to twelve types: building fires, trash fires, grass fires, vehicle fires, other fires, rescue calls, service calls, over pressure calls, hazardous conditions, miscellaneous

TABLE XIV.D.6: PROJECTED FIRE / NON-FIRE INCIDENTS FOR THE MISSION BAY PROJECT AREA, 2000 AND BUILD-OUT/2020

	2000 Alternative			2020 Alternative		
Land Use	A	B	N	A	B	N
Owner-Occupied Housing/a/	61	61	1	170	221	1
Rental Housing/b/	45	44	0	126	163	0
Affordable Housing/c/	102	95	0	253	329	0
Senior Housing/d/	7	7	0	18	23	0
Hotel	10	0	0	10	0	0
Office	21	15	15	61	15	15
S/LI/RD	35	0	0	94	11	0
Retail	5	4	7	26	31	10
Community Facilities	4	4	1	10	21	4
Park/Open Space	2	1	0	3	5	0
Port-Related/M-2 /e/	3	6	6	0	0	73
M-2 Industrial /e/	0	0	8	0	0	15
Construction/f/	15	7	2	0	0	0
TOTAL	310	244	40	771	819	118

/a/ In addition to the houseboats 50% of market rate housing is assumed to be owner-occupied. The housing mix in 2000 would differ slightly due to the sequencing of the development. Year 2000, Alt. A – 979 units, Alt. B – 969 units, Alt. N – 20 units; Year 2020, Alt. A – 2,715 units, Alt. B – 3,520 units, Alt. N – 20 units.
/b/ Fifty percent of market rate housing is assumed to be rental. Year 2000: Alt. A – 958 units, Alt. B – 948 units, Alt. N – 0 units; Year 2020: Alt. A – 2,695 units, Alt. B – 3,500 units, Alt. N – 0 units.
/c/ Thirty percent of the housing is assumed to be "affordable", 20% of which is assumed to be senior housing. Year 2000: Alt. A – 746 units, Alt. B – 690 units, Alt. N – 0 units; Year 2020: Alt. A – 1,848 units, Alt. B – 2,400 units, Alt. N – 0 units.
/d/ Twenty percent of "affordable" housing is assumed to be senior housing. Year 2000: Alt. A – 187 units, Alt. B – 173 units, Alt. N – 0 units; Year 2020: Alt. A – 462 units, Alt. B – 600 units, Alt. N – 0 units.
/e/ Includes Existing/Remaining for 2000.
/f/ Thousand square feet of building space under construction in 2000: Alt. A – 1,900, Alt. B – 900, Alt. N – 200. No construction during the build-out year.

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

calls, good intent and false alarms./4/ Based on the number of responses and out-of-service time expended on the type of incident by engine and truck companies for the years 1984, 1985 and 1986, ESA calculated the average engine and truck out-of-service time by incident type (see Table XIV.D.7)./5,6/

TABLE XIV.D.7: AVERAGE ANNUAL OUT-OF-SERVICE TIME REQUIRED BY TYPE OF FIRE / NON-FIRE INCIDENT IN SAN FRANCISCO, 1984-1986

Type of Incident/a/	Out-of-Service Time (minutes)/b/
Fire	
Building Fire	102
Other Fire	34
Grass Fire	29
Vehicle Fire	23
Trash Fire	17
Non-Fire	
Miscellaneous Call	40
Rescue Call	30
Over Pressure	24
Service Call	23
Hazardous Condition	20
False Alarm	
Good Intent	17
False Alarm	12

/a/ The types of incidents are those used by the San Francisco Fire Department, except the less common types of fire incidents have been combined into the category of "Other Fire", and the combining of Hazard Conditions and Hazardous Material Spill into Hazardous Conditions.
/b/ Out-of-service time is the total time spent servicing an incident during which the units involved are not available to respond to other incidents.

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

Using data from ESA's incident/land use sample, the percentage distribution of incident types among the different land use categories was established (see Table XIV.D.8). Multiplying the percentage of different types of incidents by the appropriate out-of-service time per incident produces an average out-of-service time per incident by land use category (see Table XIV.D.9, p. XIV.D.9). The out-of-service time demands for Mission Bay were projected by multiplying the average out-of-service time per land use category incident by the number of projected incidents for each land use category and then summing these amounts across land use categories for each EIR Alternative. The increased out-of-service time requirement was calculated by reducing the total out-of-service time requirement by the amount of out-of-service time presently absorbed within the Mission Bay Project Area (see Table XIV.D.10, p. XIV.D.9).

TABLE XIV.D.8: PERCENTAGE DISTRIBUTION OF FIRE/NON-FIRE INCIDENTS AMONG LAND USE CATEGORIES FOR SAN FRANCISCO BY PERCENTAGES, 1984-1986/a/

Land Use	Building Fire	Vehicle Fire	Other Fire	Rescue Call	Hazard Call	Service Call	Good Intent	False Alarm
Residential								
Owner-Occupied	3.8	0.0	7.6	26.4	3.8	13.2	17.9	27.4
Rental	2.0	1.0	8.9	30.7	6.9	8.9	14.9	26.7
Affordable	0.0	0.0	3.3	13.3	3.3	10.0	13.3	56.7
Senior	2.0	0.0	3.0	81.8	1.0	4.0	1.0	7.1
Hotel	1.1	1.6	8.0	32.5	2.1	1.1	17.6	36.2
Non-Residential								
Office	0.0	0.0	4.0	14.1	2.0	9.1	12.1	58.6
S/LI/RD	2.3	1.2	3.5	29.9	8.1	9.2	16.1	29.9
Retail	2.1	0.7	6.9	47.4	8.3	14.2	5.5	14.9
Community Facilities	1.7	4.3	8.6	50.0	6.9	12.1	5.2	11.2
Park/Open Space	0.0	18.2	0.0	45.5	0.0	9.1	0.0	27.3
M-2 East of Third St.	5.6	0.0	5.6	27.8	11.1	16.7	5.6	27.8
M-2 West of Third St.	0.0	0.0	0.0	50.0	0.0	0.0	0.0	50.0

/a/ Horizontal rows sum to 100%.

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

Staffing Requirements

Fire and non-fire incidents are responded to by entire engine and/or truck companies, not individual firefighters. As a result of responding to a call for service, an entire engine/truck company is unavailable to respond to other incidents. Increased service levels require the introduction of an entire company. Therefore, staffing was based on an entire engine or truck company.

As out-of-service time increases in Battalion 3, there could be an increase in the number of calls in the Project Area and the rest of the Battalion 3 service area that would require response by more-distant companies, lengthening response times. The point at which the increased number of incidents would lengthen response times to an unacceptable level is termed a threshold level. To maintain the current acceptable level of first-response availability for the surrounding areas, a fire company should be added when the increased service time demand equals the threshold level. With Engine

TABLE XIV.D.9: AVERAGE OUT-OF-SERVICE TIME PER INCIDENT BY TYPE OF LAND USE FOR SAN FRANCISCO, 1984-1986

Land Use	Out-of-Service Time per Incident (minutes)
Owner-Occupied Housing	24.5
Rental Housing	23.7
Affordable Housing	17.2
Senior Housing	29.8
Hotel	21.9
Office	17.2
S/LI/RD	22.8
Retail	26.5
Community Facilities	27.1
Park/Open Space	23.2
M-2 East of Third St.	26.2
M-2 West of Third St.	21.0
Construction	22.8

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

TABLE XIV.D.10: INCREASE IN FIRE DEPARTMENT OUT-OF-SERVICE TIME OVER 1985 LEVELS IN THE PROJECT AREA, 2000 AND BUILD-OUT/2020 (Hours per Year)

	2000 Alternative			2020 Alternative		
	A	B	N	A	B	N
Increased Time	105	80	10	270	290	40

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

Company 1 and Truck Company 1 operating near capacity, increases in out-of-service time would rapidly affect service levels and could become apparent with an additional 30 hours per month of out-of-service time./7/

Discussions with the Fire Department and the assumption that the most pressing need would be for an engine company were used to form estimated threshold levels of: 1) 25% of a Battalion 3 engine company's average out-of-service time before adding an engine company, 2) 50% of a Battalion 3 engine company's and 25% of a Battalion 3 truck company's average out-of-service time before adding a truck company, in addition to the engine company, and 3) 125% of a Battalion 3 engine company's and 100% of a Battalion 3 truck company's average out-of-service time before adding an engine company for a total of two engine companies and one truck company./8/ Based on the average out-of-service time for an engine and truck company in Battalion 3 (see Table XIV.D.11), the first three threshold levels are: 1) 80 hours out-of-service, 2) 230 hours out-of-service, and 3) 635 hours out-of-service./9/

TABLE XIV.D.11: AVERAGE OUT-OF-SERVICE TIME FOR AN ENGINE AND A TRUCK COMPANY IN BATTALION 3, 1984-1986 (Hours)

Year	Truck Company	Engine Company
1984	220	280
1985	250	350
1986	240	330
Average 1984-1986	235	320

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

By the year 2000, Alternatives A and B would require an additional engine company. By the year 2020 both a truck and engine company would be required under Alternatives A and B. The additional truck company would be staffed with 20 firefighting personnel and the additional engine company would be staffed with 15 firefighting personnel./7/

In addition to staffing truck and engine companies, three other areas were examined for additional staffing requirements: division and battalion chiefs/deputy chiefs, inspectors and support services. The service time demand for division and battalion chiefs/deputy chiefs was estimated based on the ratio of Division and Battalion service time to Engine and Truck Company service time.

It was estimated that by the year 2020, 15 additional hours of Division service time and 60 hours of Battalion service time would be spent responding to additional incidents in the Mission Bay Project Area. These times would represent an increase of less than 3% of the out-of-service time currently provided at the Division and Battalion levels. This demand can be met without additional staffing and without eroding the current level of service./7/

The demand for fire inspectors was based on the ratio of one fire inspector servicing an average of 15 million square feet of building space. A fire inspector would be required with the initial addition of 7 million square feet of commercial/industrial space. An additional inspector would not be required by the year 2000 under any of the Alternatives. However, one additional inspector would be required by the year 2020 for Alternatives A and N.

The demand for additional support personnel was estimated based on the current ratio of engine/truck company personnel to support personnel. Due to the small overall increase in engine/truck company personnel (i.e., less than 3%), no additional support staff would be required./7/

Projections of overall increased staffing requirements under the three Alternatives are shown in Table XIV.D.12.

TABLE XIV.D.12: INCREASE IN FIRE DEPARTMENT PERSONNEL OVER 1985 LEVELS IN THE MISSION BAY PROJECT AREA, 2000 AND BUILD-OUT/2020

	1986-2000 Alternative			1986-2020 Alternative		
Fire Department Personnel	A	B	N	A	B	N
Truck Company Personnel	0	0	0	20	20	0
Engine Company Personnel	15	15	0	15	15	0
Inspectors	0	0	0	1	0	1
Management/Support Personnel	0	0	0	0	0	0
TOTAL	15	15	0	36	35	1

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

Rescue Calls

Using the methodology and data used in projecting the number of fire/non-fire incidents, the number of Fire Department rescue calls were projected. Table XIV.D.13 presents the data on the reported Fire Department rescue calls from the land use sample for 1984-1986 and the resultant rescue call ratios. The rescue call ratios were then multiplied by the projected land use characteristics of each Alternative for the analysis years 2000 and build-out/2020 to project the number of rescue calls. The projected number of rescue calls for the year 2000 are 74 for Alternative A, 59 for Alternative B, and 9 for Alternative N. For the year 2020 the projected number of rescue calls are 190 for Alternative A, 202 for Alternative B, and 28 for Alternative N (see Table XIV.D.14, p. XIV.D.13).

TABLE XIV.D.13: REPORTED FIRE DEPARTMENT RESCUE CALLS ASSOCIATED WITH LAND USE CATEGORIES IN SAN FRANCISCO, 1984-1986

Land Use	Rescue Calls 1984-1986	Land Use Units/a/	Rescue Call Ratio/b/
Owner-Occupied Housing	28	564 du	0.0165/du
Rental Housing	31	721 du	0.0143/du
Affordable Housing	4	73 du	0.0183/du
Senior Housing	81	863 du	0.0313/du
Hotel	61	3,144 rooms	0.0065/room
Office	14	2,230 kgsf	0.0021/kgsf
S/LI/RD	26	1,116 kgsf	0.0078/kgsf
Retail	137	924 kgsf	0.0494/kgsf
Community Facilities	58	584 kgsf	0.0185/kgsf
Park/Open Space	5	50 acres	0.0333/acres
M-2 East of Third St.	5	411 kgsf	0.0041/kgsf
M-2 West of Third St.	1	1,112 kgsf	0.0003/kgsf

du - Dwelling units.
kgsf - Thousand gross square feet.

/a/ Total number of land use units in sample.
/b/ The incident ratio is the annual number of fire/non-fire incidents per land use unit. [(1984-1986 Incidents/3 years) / Land Use Units] = Annual Incident Ratio. The ratio is based on incidents reported.

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

TABLE XIV.D.14: PROJECTED RESCUE CALLS FOR THE MISSION BAY PROJECT AREA, 1985, 2000 AND BUILD-OUT/2020

Land Use	1985	2000 Alternative A	2000 Alternative B	2000 Alternative N	2020 Alternative A	2020 Alternative B	2020 Alternative N
Owner-Occupied Housing/a/	1	16	16	1	45	58	1
Rental Housing/b/	0	14	14	0	39	50	0
Affordable Housing/c/	0	13	12	0	33	46	0
Senior Housing/d/	0	7	7	0	16	16	0
Hotel	0	1	0	0	3	0	0
Office	0	3	2	2	9	2	2
S/LI/RD	0	10	0	0	28	3	0
Retail	0	2	2	2	12	15	5
Community Facilities	0	2	1	0	4	10	0
Park/Open Space	0	1	0	0	2	0	0
Port-Related/M-2 East of Third St./e/	2	1	2	2	0	0	19
M-2 Industrial West of Third St./e/	1	0	0	1	0	0	1
Construction/f/	1	4	2	1	0	0	0
TOTAL	5	74	58	9	191	200	28

/a/ In addition to the houseboats 50% of market rate housing is assumed to be owner-occupied. The housing mix in 2000 would differ slightly due to the sequencing of the development. Year 2000: Alt. A - 979 units, Alt. B - 969 units, Alt. N - 20 units; Year 2020: Alt. A - 2,715 units, Alt. B - 3,520 units, Alt. N - 20 units.

/b/ Fifty percent of market rate housing is assumed to be rental. Year 2000: Alt. A - 958 units, Alt. B - 948 units, Alt. N - 0 units; Year 2020: Alt. A - 2,695 units, Alt. B - 3,500 units, Alt. N - 0 units.

/c/ Thirty percent of the housing is assumed to be "affordable", 80% of which is assumed not to be senior housing. Year 2000: Alt. A - 746 units, Alt. B - 690 units, Alt. N - 0 units; Year 2020: Alt. A - 1,848 units, Alt. B - 2,400 units, Alt. N - 0 units.

/d/ Twenty percent of "affordable" housing is assumed to be senior housing. Year 2000: Alt. A - 187 units, Alt. B - 173 units, Alt. N - 0 units; Year 2020: Alt. A - 462 units, Alt. B - 600 units, Alt. N - 0 units.

/e/ Includes Existing/Remaining for 2000.

/f/ Thousand square feet of building space under construction in 2000: Alt. A - 1,900, Alt. B - 900, Alt. N - 200. No construction during the build-out year.

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Fire Department.

NOTES - Fire Protection

/1/ Eight land use categories corresponding to the planned development of Mission Bay were used: residential, office, S/LI/RD (service/light industrial/research & development), retail, community facilities, parks/open space, existing uses east of

Third Street, and existing uses west of Third Street. In addition, residential land use was categorized into owner-occupied housing, rental housing, "affordable" or subsidized housing, senior housing and hotel rooms. An indeterminant number of additional incidents (water-related rescue calls) would result from the increased population adjacent to and the planned public access to the San Francisco Bay and China Basin Channel. Those incidents have not been included in the calculations.

/2/ Computer print-out, "Permanent Record of Alarms", 1984, 1985 and 1986, San Francisco Fire Department. These records are available in the records department of the San Francisco Fire Department.

/3/ Four additional assumptions were used: 1) the market rate housing units would be split 50/50 between owner-occupied and rental units, 2) 20% of the subsidized housing would be senior housing, 3) construction incidents based on the following assumptions: a) the amount of space under construction in the year 2000 by Alternative would be: A - 1.9 million square feet, B - 0.9 million square feet, N - 0.2 million square feet; b) the length of time spent responding to incidents at construction sites is 20 minutes; and c) the ratio of incidents at construction sites is .0079 per thousand square feet. There would be no construction during the build-out analysis year since, by definition, the Alternatives would be fully developed by that time, and 4) the incident ratios for M-2 Industrial and M-2 Port Related land uses would be the same as the Existing East of Third Street land use.

/4/ The twelve types of incidents are those used in the San Francisco Fire Department's Annual Report 1985-1986 with the less common types of fire incidents combined into the category of Other Fire, and the Hazard Conditions and Hazardous Material Spill combined into Hazardous Conditions.

/5/ Computer print-out, February 7, 1987, "Company Report For Period; 01/01/84 - 12/12/84, 01/01/85 - 12/12/85, 01/01/86 - 12/12/86, San Francisco Fire Department.

/6/ Engine/truck out-of-service time is the total amount of time spent servicing an incident by either an engine or truck company. For example, if an incident should be serviced by two engine companies for 10 minutes each, and by a truck company for 15 minutes, the engine/truck out-of-service time would be 35 minutes.

/7/ Deputy Chief Gerald Cullen, San Francisco Fire Department, interview, May 11, 1987.

/8/ The Fire Department does not have an established formula for threshold levels which would vary substantially, depending on the time frame, location, equipment availability, and other service demands of a particular area in San Francisco. The actual threshold levels in the Mission Bay Project Area could vary from the estimates presented. Deputy Chief Gerald Cullen, San Francisco Fire Department, interview, May 11, 1987.

/9/ Because the capabilities of engine and truck companies differ, adequate fire protection would require the addition of a truck company prior to the engine company's out-of-service time reaching 100% of the average Battalion 3 engine company's out-of-service time. Deputy Chief Gerald Cullen, San Francisco Fire Department, telephone interview, January 17, 1987.

POLICE PROTECTION

METHODOLOGY FOR DETERMINING THE DEMAND FOR POLICE SERVICES

Tables XIV.D.8, p. XIV.D.8, and XIV.D.15 present the number of police personnel and incidents for 1985 in the Southern and Potrero Districts. Together, that information conveys the level of police protection provided to the Project Area in 1985. The projected demands for police services and associated staffing required to maintain the current citywide level of police protection in the Mission Bay Project Area for both analysis years were calculated for each of the EIR Alternatives using a two-part procedure./1/ First, an estimate of the number of police incidents was formed using police incident/land use ratios, based on the Police Department's "Reported Police Incidents" reports from a sample of sites containing land uses similar to the types under consideration for Mission Bay, and the per capita police incident ratio in the areas surrounding Mission Bay./2/ Maintenance of the current level of service in the Project Area would require additional police personnel and equipment as the number of police incidents increases. Second, the 1985 ratios of incidents per officer and support staffing per officer were used as the basis of staff increases for patrol, investigation, traffic, and support service./3/

Police Incident/Land Use Ratio

The police incident/land use ratios are the ratios of reported police incidents per land use measures on an annualized basis. Land use measures varied with the type of land use (e.g., dwelling units for residential land uses, acres for open spaces, thousands of square feet for commercial buildings space). ESA, assisted by the Department of City Planning, designed a sample of buildings and land areas from 13 land use categories consisting predominately of recently constructed buildings to estimate the number and type of police incidents associated with future land uses in the Mission Bay Project Area./2/

The San Francisco Police Department provided ESA with computer print-outs of all police incidents reported at the sample addresses for the years 1985 and 1986./4/ Ratios of the number of police incidents a) per dwelling units for privately owned, rental, "affordable", senior housing and hotel units, b) per thousand gross square feet of building space for office, S/LI/RD, retail, and community facilities, and c) per acre for parks and open spaces were then calculated. The incident ratios for the existing Mission Bay land uses East of Third Street and West of Third Street were developed using the number of incidents per Police Reporting Area./5/

The land use category "Construction" represents building space under construction. No construction would occur during the build-out year, since by definition all development would have been completed. Table XIV.D.17, p. XIV.D.18, presents the land use categories, the total floor area/dwelling units/acres, the number of incidents reported for each land use sample, and the resulting ratios of police incidents per thousand gross square feet of building floor area per dwelling unit or per acre./6/

As the first stage in projecting the number of police incidents the incident/land use ratios were multiplied by the appropriate Mission Bay Project Area land use characteristics for each EIR Alternative (see Tables V.1, p. V.8 and V.5, p. V.34 for projected land use characteristics) for the analysis years 2000 and 2020./7/

Per Capita Police Incident Ratio

The second stage of forming police incident projections was to factor in the difference between per capita incident ratios estimates for the Project Area formed in the preceding

TABLE XIV.D.15: SAN FRANCISCO POLICE PERSONNEL DISTRIBUTION, CITYWIDE AND SOUTHERN AND POTRERO DISTRICTS, FY 1984-1985

	Exempt/a/	Captain	Lieutenant	Sergeant	Inspector/ (Assistant Inspector)	Police Officer	Civilian	Total
Office of the Chief	3	1	2	5	20	31	90	152
Field Operations Bureau	3	15	42	123	28	1,160	266	1,637
Investigation Bureau	1	3	13	3	185	72	38	315
Technical Services Bureau	1	2	8	12	4	50	217	294
Administration Bureau	1	1	8	10	11	105	61	197
TOTAL	9	22	73	153	248	1,418	672	2,595
Southern District/b/	0	1	4	11	0	90	11	117
Potrero District/b/	0	1	4	9	3	92	4	113

/a/ Positions exempt from Civil Service protection, i.e., Chief, Deputy Chief and Commanders.
/b/ Southern and Potrero Districts personnel are part of the Field Operations Bureau.

SOURCE: Stars in Action: Serving Our City, Annual Report, 1984-1985, San Francisco Police Department, p. 20, and Environmental Science Associates, Inc.

TABLE XIV.D.16: INCIDENTS FOR WHICH A POLICE REPORT WAS MADE, JANUARY - DECEMBER, 1985

	Part I /a/				Part II /a/
	Commercial Burglary	Grand Theft (Over $400)	Other Theft	Other Part I	
Mission Bay/b/ (6 Reporting Areas)	30	55	95	24	93
Southern District (57 Reporting Areas)	918	1,224	3,708	2,108	7,106
Six-Reporting-Area Average for the Southern District/c/	97	129	390	222	748

/a/ Part I incidents are violent crimes (homicide, rape, robbery, thefts, burglary, larceny, motor vehicle theft, and aggravated assault). Part II incidents cover all other categories such as narcotics, vice or disorderly conduct.
/b/ Consists of Reporting Areas 286, 288, 290, 294, 295 and 297.
/c/ Average of six out of 57 reporting areas; e.g., 6/57 of 918 equals 97.

SOURCE: San Francisco Police Department, "Incidents for Which a Police Report Was Made by District, Plot and Crime," January - December 1985, and Environmental Science Associates, Inc.

step and the per capita incident ratio of the surrounding area./8/ Both the level of criminal activity in the surrounding areas and the ratio of the non-resident to resident population would influence the level of criminal activity in the Project Area. When the incident rate per capita in the surrounding area is relatively high, some of that activity can be expected to cross over into the Project Area, increasing the number of incidents. Similarly, the number of incidents tend to increase when a large non-resident population relative to the residential population provides the opportunity for criminal elements to enter the community and not arouse suspicion./8/

Six census tracts, 177, 178, 179, 180, 226 and 227, near the Project Area were defined as the surrounding area. The average number of reported police incidents over three years, 1984-1986, for police reporting areas within the census tracts was used to estimate incidents per capita in the surrounding area./9/ The average number of reported incidents per capita was 0.30./10/

Total Police Incidents

The average per capita incident ratio from the "police incident/land use ratio" estimate for the Project Area is about 0.12 and about 0.30 per capita for the surrounding area, a difference of about 0.18 incidents per capita. Non-residential incidents were assumed to increase by about 80% of the difference./11/ Because certain types of residential

TABLE XIV.D.17: REPORTED POLICE INCIDENTS ASSOCIATED WITH SAN FRANCISCO LAND USE CATEGORIES, 1985-1986

Land Use	Incidents 1985-1986/a/	Land Use Units	First Stage Incident Ratio/b/	Annual Incident Ratio
Owner-Occupied Housing	225	564 du	0.1995/du	0.3641/du
Rental Housing	222	721 du	0.1540/du	0.2811/du
Affordable Housing	23	73 du	0.1575/du	0.2874/du
Senior Housing	61	863 du	0.0353/du	0.0644/du
Hotel	170	3,144 rooms	0.0270/room	0.0594/room
Office	148	2,230 kgsf	0.0332/kgsf	0.0730/kgsf
S/LI/RD	135	1,116 kgsf	0.0605/kgsf	0.1331/kgsf
Retail	93	924 kgsf	0.0503/kgsf	0.1107/kgsf
Community Facilities	40	584 kgsf	0.0342/kgsf	0.0752/kgsf
Park/Open Space	136	50 acres	1.3600/acre	2.9920/kgsf
Existing M-2 East of Third St.	52	411 kgsf	0.0633/kgsf	0.0633/kgsf
Existing M-2 West of Third St.	542	1,112 kgsf	0.2437/kgsf	0.2437/kgsf
Construction	NA	NA	NA	0.2000/kgsf

du - Dwelling units.
kgsf - Thousand gross square feet.
NA - Not applicable.

/a/ Special computer run, San Francisco Police Department, April 10, 1987, for incidents over a two-year period reported January 1985 - December 1986 at sample addresses.
/b/ The incident ratio is the annual number of fire/non-fire incidents per land use unit. [(1985-1986 Incidents/2 years)/Land Use Units)] = Annual Incident Ratio. The ratio is based on incidents reported.

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Police Department.

incidents, such as domestic violence, generally are not influenced by non-residents, incidents associated with residential land uses were assumed to increase by a lesser amount, just over half of the difference (55%).

The first stage incident ratios were multiplied, by 1.825 for housing land use categories and 2.2 for non-housing land use categories, to produce an annual incident ratio which incorporates the incidence level of the surrounding areas. Construction incidents were assumed to occur at 0.2/kgsf, about twice the level for retail land uses. Incidents at new M-2 land uses were assumed to occur at 0.14/kgsf, about midway between the annual incident ratios of the existing M-2, east and west of Third Street./6/ These annual incident ratios are shown in Table XIV.D. 17.

As shown in Table XIV.D.18, for the year 2000, 1,725 police incidents are projected under Alternative A, 1,240 under Alternative B, and 465 under Alternative N. As shown in Table XIV.D.19, p. XIV.D.21, for the year 2020, 3,280 police incidents are projected under Alternative A, 3,395 under Alternative B, and 900 under Alternative N.

Staffing Requirements

Increases in the number of police incidents directly affect both the patrol and investigative functions in a well-defined manner./12/ The estimated demands for patrol and investigative officers were based on ratios of police incidents per patrol officer and per investigative officer./13/ Using 1984-1985 data, there were approximately 100 incidents per patrol officer and approximately 360 incidents handled by a single investigative officer./3/ In addition, patrol staffing requires one sergeant for every five patrol officers./14/ It was assumed that the number of other uniformed personnel in the divisions (e.g., Lieutenants, Captains) was not increased when the number of patrol officers increased./15/

Traffic control would also be affected by the development of Mission Bay. The assignment of traffic personnel is not based on traffic volumes, the number or types of police incidents. It was assumed that the traffic staffing levels would be maintained at their current levels relative to staffing of the patrol services./16/ Based on the 1984-1985 staffing ratios, there were 0.28 traffic officers for every patrol officer./3/ In addition, traffic personnel are staffed with one sergeant for every 15 traffic officers./14/ It was assumed that the number of other personnel in the divisions (e.g., Lieutenants, Captains) was not increased when the number of traffic officers increased./15/

Expanding the number of patrol, investigative and traffic personnel requires additional support service personnel to maintain the current level of service. Only about 85% of the support services would be affected by the increases in patrol, investigative and traffic personnel because certain positions would not be expanded (e.g., Office of the Chief of Police)./17/ Based on the 1985-1986 staffing levels, 0.45 support personnel would be required for each additional patrol, investigative or traffic officer. The ratios and factors used in determining the staffing levels are presented in Table XIV.D.20, p. XIV.D.21.

The increased number of police personnel needed in the Mission Bay Project Area to maintain San Francisco's current level of police service is presented by service category in Table XIV.D.21, p.XIV.D.22. For the year 2000, 36 additional police personnel would be required for Alternative A, 25 for Alternative B and six for Alternative N. For the build-out year 2020, 76 additional police personnel would be required for Alternative A, 81 for Alternative B and 18 for Alternative N.

TABLE XIV.D.18: PROJECTED POLICE INCIDENTS IN THE MISSION BAY PROJECT AREA, BY ALTERNATIVE, 1985 AND 2000

	1985	2000 Alternative			1986-2000 Alternative		
Land Use		A	B	N	A	B	N
Owner-Occupied Housing/a/	5	355	355	5	+350	+350	+0
Rental Housing/b/	0	270	265	0	+270	+265	+0
Affordable Housing/c/	0	215	200	0	+215	+200	+0
Senior Housing/d/	0	10	10	0	+10	+10	+0
Hotel	0	30	0	0	+30	+0	+0
Office	0	105	75	75	+105	+75	+75
S/LI/RD	0	175	0	0	+175	+0	+0
Retail	0	5	5	5	+5	+5	+5
Community Facilities	0	5	5	0	+5	+5	+0
Park/Open Space	0	100	55	0	+100	+55	+0
M-2 Port-Related/e/	25	10	25	25	-15	+0	+0
M-2 Industrial/e/	270	65	65	315	-205	-205	+45
Construction/f/	0	380	180	40	+380	+180	+40
TOTAL	300	1,725	1,240	465	+1,425	+940	+165

/a/ In addition to the houseboats 50% of market rate housing is assumed to be owner-occupied. The mix in 2000 would differ slightly due to the sequencing of the development. Year 2000: Alt. A - 979 units, Alt. B - 969 units, Alt. N - 20 units; Year 2020: Alt. A - 2,715 units, Alt. B - 3,520 units, Alt. N - 20 units.

/b/ Fifty percent of market rate housing is assumed to be rental. Year 2000: Alt. A - 958 units, Alt. B - 948 units, Alt. N - 0 units; Year 2020: Alt. A - 2,695 units, Alt. B - 3,500 units, Alt. N - 0 units.

/c/ Thirty percent of the housing is assumed to be subsidized or "affordable", 20% of which is assumed to be senior housing. Year 2000: Alt. A - 746 units, Alt. B - 690 units, Alt. N - 0 units; Year 2020: Alt. A - 1,848 units, Alt. B - 2,400 units, Alt. N - 0 units.

/d/ Twenty percent of "affordable" housing is assumed to be senior housing. Year 2000: Alt. A - 187 units, Alt. B - 173 units, Alt. N - 0 units; Year 2020: Alt. A - 462 units, Alt. B - 600 units, Alt. N - 0 units.

/e/ Includes Existing/Remaining for 2000.

/f/ Thousand square feet of building space under construction in 2000: Alt. A - 1,900, Alt. B - 900, Alt. N - 200. No construction during the build-out year.

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Police Department.

TABLE XIV.D.19: PROJECTED POLICE INCIDENTS IN THE PROJECT AREA BY ALTERNATIVE, 2000 AND BUILD-OUT/2020

Land Use	2000 Alternative			2020 Alternative			2001-2020 Alternative		
	A	B	N	A	B	N	A	B	N
Owner-Occupied Housing	355	355	5	990	1,280	5	+635	+925	+0
Rental Housing	270	265	0	755	985	0	+485	+720	+0
Affordable Housing	215	200	0	530	690	0	+315	+490	+0
Senior Housing	10	10	0	30	40	0	+20	+30	+0
Hotel	30	0	0	30	0	0	+0	+0	+0
Office	105	75	75	300	75	75	+195	+0	+0
S/LI/RD	175	0	0	480	55	0	+305	+55	+0
Retail	5	5	5	25	35	10	+20	+30	+5
Community Facilities	5	5	0	10	25	5	+5	+20	+5
Park/Open Space	100	55	0	130	210	0	+30	+155	+0
M-2 East of Third St.	10	25	25	0	0	435	-10	-25	+410
M-2 West of Third St.	65	65	315	0	0	370	-65	-65	+55
Construction	380	180	40	0	0	0	-380	-180	-40
TOTAL	1,725	1,240	465	3,280	3,395	900	+1,555	+2,155	+435

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Police Department.

TABLE XIV.D.20: SAN FRANCISCO POLICE PERSONNEL RATIOS AND FACTORS, FY 1984-1985

100 Incidents per Patrol Officer
1 Sergeant per 5 Patrol Officers
360 Incidents per Investigative Officer
0.28 Traffic Officer per Patrol Officer
1 Sergeant per 15 Traffic Officers
0.45 Support Personnel for Each Additional Patrol, Investigative or Traffic Officer
9 Police Personnel Servicing the Mission Bay Project Area, 1985

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Police Department.

TABLE XIV.D.21: POLICE PERSONNEL SERVICING THE MISSION BAY PROJECT AREA, 1985, 2000 AND BUILD-OUT/2020

Police Personnel	1985	2000 Alternative			1986-2000 Alternative			2020 Alternative			2001-2020 Alternative		
		A	B	N	A	B	N	A	B	N	A	B	N
Patrol	7	24	18	9	+17	+11	+2	43	44	16	+19	+26	+7
Investigative	0	4	3	1	+4	+3	+1	8	9	2	+4	+6	+1
Traffic	0	4	3	1	+4	+3	+1	9	10	2	+5	+7	+1
Support	2	13	10	4	+11	+8	+2	25	27	7	+12	+17	+3
TOTAL	9	45	34	15	+36	+25	+6	85	90	27	+40	+56	+12

SOURCE: Environmental Science Associates, Inc., based on information provided by the San Francisco Police Department.

NOTES - Police Protection

/1/ The fact that types of crime, attitudes toward crime, and police technology will be subject to change in the future reduces the reliability of any methodology for predictive purposes, but not for the comparative purposes under consideration. Although a single estimate of the number of police incidents is presented for each Alternative for the two analysis years, these should not be considered exact estimates, but rather midpoints in a range of plus or minus 20%.

/2/ "Reported police incidents" records contain the street address associated with each incident. The number and types of incidents can therefore be associated with different land uses. Eight land use categories corresponding to the planned development of Mission Bay were used: residential, office, S/LI/RD, retail, community facilities, parks/open space, existing uses east of Third Street, and existing uses west of Third Street. In addition, residential land use was further categorized into owner-occupied housing, rental housing, "affordable" housing, senior housing and hotel rooms. The list of addresses used to generate the number of incidents per land use is available for public review at the Office of Environmental Review, at 450 McAllister Street, Fourth Floor, San Francisco, CA 94102.

/3/ San Francisco Police Department, Office of the Police Commission, Stars in Action, Serving Our City, San Francisco Police Department Annual Report, Fiscal Year 1984-1985, July 9, 1985, p. 17.

/4/ "Addresses For Use in the Community Services Analysis", letter, San Francisco Police Department, April 17, 1987.

/5/ "Incidents For Which a Police Report Was Made by District, Plot, and Crime", San Francisco Police Department, January 1985 - December 1986, 1987. It was also assumed that with increased activity in the Project Area the incident ratio for M-2 Industrial and M-2 Port Related uses would be 50% greater than the incident ratio for existing east of Third Street uses.

/6/ In addition to incidents at construction sites, the incident rate would be higher in areas adjacent to construction. A ratio of 0.2 incidents per thousand gross square feet of building under construction was assumed for construction-related police incidents on the basis of incident rates for other land uses. Sergeant Tom Del Torre, Crime Prevention Unit, San Francisco Police Department, interview, May 20, 1987.

/7/ Three additional assumptions were used: 1) market-rate housing units would be split 50/50 between owner-occupied and rental units, 2) 20% of the subsidized housing would be senior housing, and 3) construction incidents based on the following assumptions: a) space under construction in the year 2000 by Alternative would be A - 1.9 million square feet; B - 0.9 million square feet; N - 0.2 million square feet and b) a ratio of 0.2 police incidents per thousand square feet under construction. There would be no construction during the build-out year since, by definition, the Alternatives would be fully developed by that time.

/8/ The results of a study of police incidents in a section of the Western Addition bounded by Turk, Vallejo, and Steiner Streets and Van Ness Avenue suggest that neighborhoods adjacent to areas with higher incident ratios experience higher incident rates than other neighborhoods with similar land use characteristics. These higher rates ranged from 35% to 80% of the difference between a neighborhood and its adjacent neighborhood area with the higher incident rates. Harold E. Waterman, Senior Management Assistant, Planning Division, San Francisco Police Department, interview, February 15, 1988.

/9/ Police reporting area 258 experiences an extremely high number of incidents, most of which are generated at the Hall of Justice and connected with the inmates of the county jail. This area was therefore excluded from calculations of the incidents per capita in the area surrounding Mission Bay.

/10/ The six census tracts had a 1985 population of approximately 20,300 and the annual number of reported police incidents averaged about 6,000 during the three-year period 1984-1986.

/11/ Steve Lutes, Senior Administrative Analyst, Planning Division, San Francisco Police Department, interview, February 23, 1988.

/12/ The number of incidents would not precisely correspond to the demand for police services because 1) different types of incidents require different amounts of service time, and 2) some incidents require the response of several units while other incidents are handled by a single unit. Quantitative data is not available to make such adjustments. In addition, only 10 to 20% of an officer's time is spent responding to incidents, the majority is spent keeping the peace and maintaining order. It has been assumed that the proportion of incidents to an officer's service time remains constant across land uses and over time. Lieutenant Thomas W. Suttmeier, Commanding Officer, Planning Division, San Francisco Police Department, interview, May 11, 1987.

/13/ Although information on type of incident was available, data on the amount of time police spend in response to different types of police incidents was not available. No further precision was to be gained through incorporating the incident type.

/14/ Lieutenant Thomas W. Suttmeier, Commanding Officer, Planning Division, San Francisco Police Department, interview, May 11, 1987.

/15/ The demand for other uniformed personnel (e.g., Lieutenants and Captains) are more closely associated with the number of police districts and stations than with the number of police incidents.

/16/ Demand for traffic control officers may be understated. The demand for traffic control is not spread evenly throughout the city, but is concentrated in the commercial, eastern third of San Francisco.

/17/ The 85% proportion has been used by Gruen Gruen + Associates, 1981, Fiscal Impacts of New Downtown High-Rises on the City and County of San Francisco, and Department of City Planning, City and County of San Francisco, The Downtown Plan, Environmental Impact Report, EE81.3, 1984.

SCHOOLS

TABLE XIV.D.22: SAN FRANCISCO UNIFIED SCHOOL DISTRICT ENROLLMENT AND CAPACITY, 1985-1986

School	Enrollment	Capacity	Residual Capacity	Percent Utilization
Elementary (Grades K-5)	28,880	29,787	907	97%
Middle (Grades 6-8)	13,429	14,294	865	94%
High (Grades 9-12)	21,078	22,636	1,558	93%
TOTAL	63,387	66,717	3,330	95%

SOURCE: San Francisco Unified School District, "Active Enrollment, Spring 1986," and "School Capacity Report," September 1986; and Environmental Science Associates, Inc.

TABLE XIV.D.23: APPROXIMATE NUMBER OF PUBLIC SCHOOL STUDENTS LIVING IN MISSION BAY AND ADJACENT NEARBY AREAS, 1985-1986/a/

Area	Number of Students	Percent of District-wide Enrollment
Mission Bay Project Area	0 /b/	-
Showplace / North Potrero Hill	0	-
South of Market/c/	340	0.5%
Inner Mission/d/	7,343	11.6%
Potrero Hill/e/	950	1.5%
Lower Potrero Hill / Central Bayfront (part)/f/	37	0.06%
TOTAL MISSION BAY AND ADJACENT NEARBY AREAS	8,670	13.7%
TOTAL DISTRICT-WIDE	63,387	100%

/a/ Enrollment figures for 1985-1986 are estimates based on 1986-1987 school year enrollment data from "Summary of SFUSD Student Population by 1970 Census Tract," (computer print-out, San Francisco Unified School District, October 15, 1986. That computer print-out shows the number of SFUSD students as of October 1, 1986 who live in each area as defined by 1970 U.S. Census tracts). SFUSD collects the enrollment data by 1970 Census Tracts (instead of 1980 tracts) so that it will be consistent with historical data collected by 1970 tracts. Enrollment figures for these areas are approximate becaue census tracts, the areas for which enrollment data are collected, do not conform exactly to the boundaries drawn for the Nearby Areas, presented in Figure IV.1, p. IV.5.
/b/ Two students attend private schools.
/c/ 1980 U.S. Census Tracts 178, 179.01, and 180.
/d/ 1980 Tracts 177, 201, 202, 207, 208, 209, 210, 228, and 229.
/e/ 1980 Tract 227.
/f/ 1980 Tract 226.

SOURCE: San Francisco Unified School District and Environmental Science Associates, Inc.

Mission Bay

SOURCE: Environmental Science Associates, Inc.
and S.F. Unified School District

FIGURE XIV.D.1
PUBLIC SCHOOLS

TABLE XIV.D.24: ENROLLMENT AND CAPACITY OF PUBLIC SCHOOLS IN ADJACENT NEARBY AREAS, FY 1985-1986

School/a/	Enrollment	Capacity/b/	Residual Capacity	Percent Utilization
Elementary (Grades K-5)				
E1. Daniel Webster	393	430	37	91%
E2. Starr King	455	460	5	99%
E3. Bessie Carmichael	422	420	-2	100%
E4. Bryant	339	340	1	100%
E5. Buena Vista	201	160	-41	126%
E6. George R. Moscone	371	360	-11	103%
E7. Marshall	367	330	-37	111%
E8. Hawthorne	601	610	9	99%
TOTAL	3,149	3,110	-39	101%
Middle (Grades 6-8)				
M1. Potrero Hill	624	700	76	89%
M2. Horace Mann	493	500	7	99%
TOTAL	1,117	1,200	83	93%
High (Grades 9-12)				
H1. John O'Connell	424	700	276	61%
H2. Sunshine	193	300	107	64%
H3. Downtown	257	160	-97	161%
H4. Mission	1,916	2,071	155	93%
TOTAL	2,790	3,231	441	86%

/a/ School locations are shown on Figure XIV.D.1, p. XIV.D.26.
/b/ Capacity is based on 1985-1986 conditions.

SOURCE: San Francisco Unified School District, "Active Enrollment, Spring 1986," and "School Capacity Report," September 1986; and Environmental Science Associates, Inc.

TABLE XIV.D.25: ESTIMATED NUMBER OF SFUSD STUDENTS WHO MAY NOT BE ACCOMMODATED WITHIN EXISTING SCHOOLS AND ASSOCIATED SPACE SHORTFALLS, MISSION BAY AND CITYWIDE, 2000 AND BUILD-OUT/2020

	Alternative A								
	2000			2020			2001–2020		
	Students/a/	Classrooms/b/	Schools/c/	Students/a/	Classrooms/b/	Schools/c/	Students/a/	Classrooms/b/	Schools/c/
Kindergarten–Grade 5 (Elementary)									
Mission Bay	256 (16%)	9	0.6	673 (18%)	25	1.5	+417	+16	+0.9
Adjacent Nearby Areas	560 (35%)	21	1.2	1,460 (39%)	54	3.2	+900	+33	+2.0
Citywide	1,590 (100%)	59	3.5	3,745 (100%)	139	8.3	+2,155	+80	+4.8
Grades 6–8 (Middle)									
Mission Bay	149 (16%)	5	0.2	323	12	0.4	+174	+7	+0.2
Citywide	910 (100%)	34	1.1	1,755 (100%)	65	2.1	+845	+31	+1.0
Grades 9–12 (High)									
Mission Bay	211 (14%)	8	0.1	450	16	0.3	+239	+8	+0.2
Citywide	1,470 (100%)	54	0.8	2,470 (100%)	91	1.4	+1,000	+37	+0.6
TOTAL GRADES K–12									
Mission Bay	616 (15.5%)	22		1,446 (18%)	53		+830	+31	
Citywide	3,970 (100%)	147		7,970 (100%)	295		+4,000	+148	
	Alternative B								
	2000			2020			2001–2020		
	Students/a/	Classrooms/b/	Schools/c/	Students/a/	Classrooms/b/	Schools/c/	Students/a/	Classrooms/b/	Schools/c/
Kindergarten–Grade 5 (Elementary)									
Mission Bay	229 (14%)	8	0.5	870 (22%)	32	1.9	+641	+24	+1.4
Adjacent Nearby Areas	560 (35%)	21	1.2	1,460 (37%)	54	3.2	+900	+33	+2.0
Citywide	1,590 (100%)	59	3.5	3,980 (100%)	147	8.8	+2,390	+88	+5.3
Grades 6–8 (Middle)									
Mission Bay	133 (15%)	5	0.2	418 (22%)	15	0.5	+285	+10	+0.3
Citywide	910 (100%)	34	1.1	1,865 (100%)	69	2.2	+955	+35	+1.1
Grades 9–12 (High)									
Mission Bay	195 (13%)	7	0.1	584 (22%)	21	0.33	+389	+14	+0.2
Citywide	1,470 (100%)	54	0.8	2,625 (100%)	97	1.5	+1,155	+43	+0.7
TOTAL GRADES K–12									
Mission Bay	557 (14%)	20		1,872 (22%)	68		+1,315	+48	
Citywide	3,970 (100%)	147		8,470 (100%)	313				

(continued)

TABLE XIV.D.25: ESTIMATED NUMBER OF SFUSD STUDENTS WHO MAY NOT BE ACCOMMODATED WITHIN EXISTING SCHOOLS AND ASSOCIATED SPACE SHORTFALLS, MISSION BAY AND CITYWIDE, 2000 AND BUILD-OUT/2020 (continued)

	Alternative N								
	2000			2020			2001-2020		
	Students/a/	Classrooms/b/	Schools/c/	Students/a/	Classrooms/b/	Schools/c/	Students/a/	Classrooms/b/	Schools/c/
Kindergarten-Grade 5 (Elementary)									
Mission Bay	1 (0.1%)	--	--	1 (0.0%)	--	--	+0	+0	+0
Adjacent Nearby Areas	560 (38%)	21	1.2	1,460 (45%)	54	3.2	+900	+33	+2.0
Citywide	1,465 (100%)	54	3.3	3,230 (100%)	120	7.2	+1,765	+66	
Grades 6-8 (Middle)									
Mission Bay	1 (0.1%)	--	--	1 (0.1%)	--	--	+0	+0	+0
Citywide	845 (100%)	31	1.0	1,510 (100%)	56	1.8	+665	+25	
Grades 9-12 (High)									
Mission Bay	1 (0.1%)	--	--	1 (0.0%)	--	--	+0	+0	+0
Citywide	1,360 (100%)	51	0.8	2,130 (100%)	79	1.2	+770	+28	
TOTAL GRADES K-12									
Mission Bay	3 (0.1%)	--		3 (0.0%)	--		+0	+0	
Citywide	3,670 (100%)	136		6,870 (100%)	255		+3,200	+119	

/a/ "Students" column reports the number of SFUSD students for whom there may not be sufficient classroom space in existing open school buildings. The estimated number of elementary, middle and high school students from the Mission Bay Project Area is also expressed in (__) as a percentage of the estimated number of students citywide (including Mission Bay) who could need space.

/b/ "Classrooms" column shows the number of classrooms associated with serving the students who could need space. Classroom requirements estimated using a SFUSD standard of 27 students per classroom.

/c/ "Schools" column shows the number of schools (or portions of schools) that could be needed to fulfill the space shortfall. School requirements estimated using the following typical SFUSD school sizes: elementary school - 450 students; middle school - 850 students; high school - 1,750 students.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.D.26: ESTIMATED NUMBER OF PUBLIC SCHOOL STUDENTS LIVING IN ADJACENT NEARBY AREAS, ALL ALTERNATIVES, 1985, 2000 AND BUILD-OUT/2020

	Students (Grades K-12)/a/						
Area	1985/b/	2000	Change 1986-2000	% Change 1986-2000	2020	Change 2001-2020	% Change 2001-2020
South-of-Market/c/	340	1,010	+670	+197%	1,530	+520	+51%
Inner Mission/d/	7,343	7,090	-253	-3%	7,100	+10	+0.1%
Potrero Hill/e/	950	1,020	+70	+7%	1,040	+20	+2%
Lower Potrero Hill / Central Bayfront (part)/f/	37	40	+3	+8%	30	-10	-25%
TOTAL	8,670	9,160	+490	+6%	9,700	+540	+6%

/a/ Future enrollment estimates are based on State Department of Finance age distribution projections and Recht Hausrath & Associates population projections for Mission Bay Alternatives and Nearby Areas.
/b/ Figures for 1985 are estimates based on 1986-1987 school year enrollment data from "Summary of SFUSD Student Population by 1970 Census Tract," (computer print-out), San Francisco Unified School District, October 15, 1986. Enrollment figures for these areas are approximate because census tracts, the areas for which enrollment data are collected, do not conform exactly to the boundaries drawn for the Nearby Areas, presented in Figure IV.2, p. IV.6.
/c/ 1980 U.S. Census Tracts 178, 179.01, and 180.
/d/ 1980 Tracts 177, 201, 202, 207, 208, 209, 210, 228, and 229.
/e/ 1980 Tract 227.
/f/ 1980 Tract 226.

SOURCE: Environmental Science Associates, Inc. based on information from the San Francisco Unified School District.

TABLE XIV.D.27: ESTIMATED AGE DISTRIBUTION OF PROJECT AREA POPULATION, BY ALTERNATIVE, 2000/a/

Age	Grade	Alternative A	Alternative B	Alternative N
0-4	-	253	226	1
5-10	K-5	356	318	1
11-13	6-8	207	185	1
14-17	9-12	274	253	2
18-64	-	3,540	3,309	27
65+	-	815	756	4
TOTAL		5,445	5,047	36

/a/ Based on California Department of Finance estimates of age distribution of the San Francisco population in 2000.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.D.28: ESTIMATED AGE DISTRIBUTION OF PROJECT AREA POPULATION, BY ALTERNATIVE, 2020/a/

Age	Grade	Alternative A	Alternative B	Alternative N
0-4	-	756	977	1
5-10	K-5	935	1,208	1
11-13	6-8	449	580	1
14-17	9-12	585	758	1
18-64	-	9,514	12,345	28
65+	-	2,158	2,799	4
TOTAL		14,397	18,667	36

/a/ Based on California Department of Finance estimates of the age distribution of the San Francisco population in 2020.

SOURCE: Environmental Science Associates, Inc.

RECREATION AND PARKS

TABLE XIV.D.29: GENERAL AREA REQUIREMENTS FOR SPORTS ACTIVITIES, PLAY AREAS AND RECREATION BUILDINGS

	Area Requirement	
Sports Activity	Square Feet	Acres
Baseball	90,000	2.1
Soccer	86,000	2.0
Softball	63,000	1.4
Football (Touch)	58,000	1.3
Tennis (One Court for 2-4 Players)	7,000	0.2
Basketball	6,000	0.1
Volleyball	4,000	0.1
Handball	1,300	0.03
Play Areas		
Tot Lot	6,500	0.15
Playground	130,700	3.0
Recreation Buildings		
Multipurpose/Assembly Room (with Kitchen)	2,500	0.06
Gym	6,500	0.15

SOURCE: Ontario Department of Education, Community Programs Division, Standards and Definition of Terms, as cited in Joseph DeChiara and Lee E. Koppelman, Site Planning Standards, McGraw-Hill, Inc., 1978; San Francisco Recreation and Park Department and Environmental Science Associates, Inc.

PUBLIC HEALTH SERVICES

Estimates of Project Area Ambulance Calls

Table XIV.D.30 presents estimates of the annual Code 1 and 2, Code 3, and total ambulance calls expected in the Project Area in 1985 and in 2000 and 2020. Code 1 calls are for routine transport, such as scheduled rides to the hospital for bed-ridden patients. Code 2 calls are "urgent," but with no imminent danger (e.g., a fractured leg) and Code 3 calls are "life-threatening emergencies," such as a heart attack. The San Francisco Fire Department also responds to all Code 3 medical emergencies. All fire personnel are trained in resuscitation and first aid, and all fire companies carry first aid equipment. The estimates were developed using two different approaches: One approach estimated Project Area ambulance calls resulting from population growth, based on the City's existing annual ambulance calls per capita. The other approach derived "ambulance call factors" for various San Francisco land use types from the Fire Department's statistics on medical related (Code 3) calls. These factors were then applied to the land use program for each Alternative to yield the expected number of Code 3 calls. The estimated numbers of Code 3 calls were then used to derive the expected number of all calls.

These two approaches are further explained as follows:

Per Capita Method

There is a total of about 69,300 ambulance calls to residents, businesses and all other land uses in San Francisco each year. With a 1985 total City population of about 742,000, ambulance calls average about 93 calls per 1,000 City residents. This factor (93 calls/1,000 residents) was applied to the estimated Project Area residential population to estimate the total number of ambulance calls to all land uses in the Project Area each year. DPH statistics show that about 80% of total calls are Code 1 and 2 calls and about 20% are Code 3 calls. These proportions were applied to the estimated total calls to estimate Code 1 and 2 calls and Code 3 calls. This method was used to estimate calls under Alternatives A and B because these alternatives are defined chiefly by their residential/mixed-use character.

Land Use/Fire Department Statistics Method

This method was used to estimate 1985 calls, and calls under Alternative N in 2000 and 2020. Because the existing uses in the Project Area and the uses under the No-Project Alternative would be defined primarily by a low-density industrial and service character, a factor based on residential population would not be appropriate to estimate future calls. Rather, Fire Department statistics on rescue calls (e.g., first aid or resuscitation) by address were consulted to develop factors of annual medical emergency calls by land use type (e.g., industrial, maritime, service) and size. These factors were applied to the Project Area's existing and Alternative N land use programs to estimate future Code 3 calls (see p. XIV.D.4, Fire Service). Estimates of Code 1 and 2 calls, and total calls were then derived from the Code 3 estimates.

Total annual ambulance calls to the Project Area would increase from about 25 in 1985 to about 50 under Alternative N, 470 under Alternative B and 510 under Alternative A in the year 2000. Total calls would increase further by the year 2020 to about 160 under Alternative N, 1,340 in Alternative A and 1,730 in Alternative B.

TABLE XIV.D.30: ESTIMATED ANNUAL PROJECT AREA AMBULANCE CALLS, 1985, 2000 AND 2020/a/

	1985	2000 Alternative			2020 Alternative		
		A	B	N	A	B	N
Codes 1 and 2/b/	20	400	370	40	1,060	1,370	125
Code 3	5	110	100	10	280	360	35
TOTAL	25	510	470	50	1,340	1,730	160

/a/ These estimates are for total ambulance calls, including service provided by the Paramedic Division of the San Francisco General Hospital and back-up service provided by private ambulance companies. Ambulance calls estimates for 1985 and Alternative N are ESA estimates based on Fire Department statistics on medical-related (rescue) calls (see Fire Service, p. XIV.D.4). Estimates for Alternatives A and B are based on a factor of 93 total calls per 1,000 residents per year.

/b/ Code 1 medical calls are for routine transport and Code 2 calls are urgent, but with no imminent danger (e.g., a fractured leg). Code 3 calls are life-threatening emergencies.

SOURCE: Environmental Science Associates, Inc.

Estimates of City Responses and Paramedic and Vehicle Requirements

Based on the estimates of total calls in Table XIV.D.30, and the fact that about 75% of the City's total annual ambulance responses are made by City ambulances, Tables VI.D.20 and VI.D.21, pp. VI.D.96 and VI.D.99 present estimates of annual City ambulance responses to the Project Area in the year 2000 and 2020. Those tables also present estimates of the DPH paramedics and vehicles that would be required to handle the calls. The paramedic estimates were based on a factor that each City paramedic (full-time equivalent) handles about 960 calls per year. About seven City ambulances are available for use at any given time. Ambulances are staffed 24 hours a day by two paramedics who work eight-hour shifts. Thus, about 42 full-time-equivalent (FTE) paramedics are needed to operate the City ambulance fleet (seven ambulances x two paramedics x three eight-hour shifts). In addition, the multi-casualty vehicle requires about ten FTE paramedics (three paramedics x three eight-hour shifts). The total of 52 paramedics (FTE) handles about 50,000 calls per year, or about 960 calls per paramedic.

The vehicle estimates were based on a factor that each City ambulance handles about 3,570 calls each year. (The City's fleet of 14 vehicles handles about 50,000 calls per year, or about 3,570 calls per vehicle.) Those factors and the resultant estimates reflect both the existing proportion of calls that are handled by the City and the existing levels of service.

TABLE XIV.D.31: PROJECT AREA POPULATION AT RISK OF MENTAL HEALTH ILLNESS, 2000/a/

	Risk Factor (%)			Alternative A			Alternative B			Alternative N/b/		
Age Group	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
0-17	29.9%	10.0%	1.5%	326	109	16	294	98	15	1	1	0
18-64	27.0%	9.1%	2.4%	956	322	85	893	301	79	7	2	1
65+	27.2%	10.1%	1.8%	222	82	15	206	76	14	1	0	0
TOTAL				1,504	513	116	1,393	475	108	9	3	1

/a/ Risk levels are defined as low, medium and high. Low-risk population includes those who might use consultation, education, prevention or early intervention services. Moderate-risk cases are those who might need outpatient treatment with occasional inpatient stay. High-risk cases include those who might need inpatient care.

/b/ Population at risk is identical to existing conditions.

SOURCE: San Francisco Department of Public Health, Community Mental Health Service, and Environmental Science Associates, Inc.

TABLE XIV.D.32: MISSION BAY POPULATION AT RISK OF MENTAL HEALTH ILLNESS, 2020/a/

Age Group	Risk Factor (%)			Alternative A			Alternative B			Alternative N/b/		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
0-17	29.9%	10.0%	1.5%	815	273	41	1,053	352	53	1	0	0
18-64	27.0%	9.1%	2.4%	2,569	866	228	3,333	1,123	296	8	2	1
65+	27.2%	10.1%	1.8%	587	218	39	761	280	50	1	0	1
TOTAL				3,971	1,357	308	5,147	1,755	399	10	2	2

/a/ Risk levels are defined as low, medium and high. Low-risk population includes those who might use consultation, education, prevention or early intervention services. Moderate-risk cases are those who might need outpatient treatment with occasional inpatient stay. High-risk cases include those who might need inpatient care.

/b/ Population at risk is identical to existing conditions.

SOURCE: San Francisco Department of Public Health, Community Mental Health Service, and Environmental Science Associates, Inc.

WATER SUPPLY

Water Demand in the Mission Bay Project Area

The University Mound pressure zone includes 15 water service districts. Portions of three districts serve Mission Bay. District 4 includes the portion of the site north of Channel Street. District 8 covers the central portion of the site bounded by 16th Street on the south and Channel Street on the north; District 9, the area south of 16th Street and approximately east of Third Street. The most recent water consumption measurements for the Mission Bay area service districts are shown in Table XIV.D.33. The Water Department's historic records show that pipelines have delivered greater amounts of water to these districts in the past. Historical water demand in the Project Area is shown in Table XIV.D.34. No data are available for water consumption within specific Mission Bay Project Area boundaries.

TABLE XIV.D.33: MOST RECENT WATER DEMAND IN PROJECT AREA AND VICINITY (Million Gallons per Day)

District	Consumption	Year
District 4	1.09 mgd	1973-1974
District 8	1.09 mgd	1975
District 9	1.27 mgd	1975

SOURCE: San Francisco Water Department

TABLE XIV.D.34: HISTORICAL WATER DEMAND IN PROJECT AREA AND VICINITY

District	Highest Historical Consumption (mgd)/a/	Peak Hour (mg)	Year
District 4	1.89	0.108	1961
District 8	1.42	0.085	1963
District 9	1.59	0.103	1970

mgd - million gallons per day.
mg - million gallons.

/a/ Readings have been taken on random warm spring days every four to five years since 1961. Actual peak consumption may be higher than what occurred on that single day.

SOURCE: San Francisco Water Department.

TABLE XIV.D.35: MISSION BAY WATER DEMAND CALCULATIONS, 2000

Land Use	Demand Factor/a/	Alternative A	Water Demand (gpd)	Alternative B	Water Demand (gpd)	Alternative N	Water Demand (gpd)
Residential (Includes Houseboats)	75 gpd/resident/b/	5,445 residents	408,375	5,047 residents	378,525	36 residents	2,700
S/LI/RD	126 gpd/1,000 sq. ft.	1,330,000 sq. ft.	167,580	0	0	NA	NA
Retail	95 gpd/1,000 sq. ft.	50,000 sq. ft.	4,750	40,000 sq. ft.	3,800	65,000 sq. ft.	6,175
Office	57 gpd/1,000 sq. ft.	1,440,000 sq. ft.	82,080	1,000,000 sq. ft.	57,000	1,000,000 sq. ft.	57,000
Hotel	170 gpd/room	500 rooms	85,000				
Community Facility Open Space Maint.	20 gpd/employee	53 employees	1,060	57 employees	1,140	0 employees	0
Train/Pump Station	140 gpd/1,000 sq. ft.	22,000 sq. ft.	3,000	22,000 sq. ft.	3,000	22,000 sq. ft.	3,000
Existing/Remaining East of Third	60 gpd/1,000 sq. ft.	176,000 sq. ft.	10,560	397,000 sq. ft.	23,820	397,000 sq. ft.	23,820
Existing/Remaining West of Third	80 gpd/1,000 sq. ft.	264,000 sq. ft.	21,120	264,000 sq. ft.	21,120	980,000 sq. ft.	78,400
Open Space (Land)	300 gpd/acre	33.4 acres	10,020	16.3 acres	4,890	3.4 acres	1,020
TOTAL			793,545		493,295		172,115

gpd - gallons per day.
NA - Not applicable

/a/ Factors used to calculate water demand were derived from water billing records of similar San Francisco land uses provided by the San Francisco Water Department.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.D.36: MISSION BAY WATER DEMAND CALCULATIONS, 2020

Land Use	Demand Factor/a/	Alternative A	Water Demand (gpd)	Alternative B	Water Demand (gpd)	Alternative N	Water Demand (gpd)
Residential (Includes Houseboats)	75 gpd/resident/b/	14,397 residents	1,079,775	18,667 residents	1,400,025	36 residents	2,700
S/LI/RD	126 gpd/1,000 sq. ft.	3,600,000 sq. ft.	453,600	420,000 sq. ft.	52,920	NA	NA
Retail	95 gpd/1,000 sq. ft.	250,000 sq. ft.	23,750	300,000 sq. ft.	28,500	100,000 sq. ft.	9,500
Office	57 gpd/1,000 sq. ft.	4,100,000 sq. ft.	233,700	1,000,000 sq. ft.	57,000	1,000,000 sq. ft.	57,000
Hotel	170 gpd/room	500 rooms	85,000	0	0	0	0
Community Facility Open Space Maint.	20 gpd/employee	165 employees	3,300	385 employees	7,700	55 employees	1,100
Train/Pump Station	140 gpd/1,000 sq. ft.	22,000 sq. ft.	3,000	22,000 sq. ft.	3,000	22,000 sq. ft.	3,000
M-2 West of Third	NA	NA	NA	NA	NA	5,000,000 sq. ft.	450,000
				NA	NA	1,048,000 sq. ft.	62,880
Port-Related/ East of Third	NA	NA	NA	45.3 acres	13,590	5.2 acres	1,560
Open Space (Land)	300 gpd/acre	43.3 acres	12,990		1,562,735		587,740
TOTAL			1,895,115				

NA – Not applicable.
gpd – gallons per day.

/a/ Factors used to calculate water demand were derived from water billing records of similar San Francisco land uses provided by the San Francisco Water Department.

SOURCE: Environmental Science Associates, Inc.

SEWERS AND WASTEWATER TREATMENT

TABLE XIV.D.37: SAN FRANCISCO WATER POLLUTION CONTROL PLANTS, 1985

Plant	Treatment Capacity/a/	Average Dry-Weather Flow/a/	Teatment Process/b/
Richmond-Sunset	45 mgd	22 mgd primary	Chemical-assisted
Southeast	142 mgd	85.4 mgd	Biological secondary/c/
North Point	140± mgd, depending on tide	--	Chemical-assisted primary

mgd - million gallons per day.

/a/ David Jones, Planning and Control Division, San Francisco Clean Water Program, interview, September 25, 1986 and Don Munakata, Project Manager, San Francisco Clean Water Program, telephone conversation, August 3, 1987. Treatment capacity also is defined as peak wet-weather flow. Treatment plants are at full capacity during the rainy season and have excess capacity during dry weather.

/b/ Chemical-assisted primary treatment requires the addition of chemicals (lime, ferric chloride and polymer) to assist in the removal of suspended solids. After chemical addition, the wastewater is mixed and the suspended material coagulates. The wastewater then flows to the sedimentation tanks where coagulated material settles to the bottom. The settled sludge is removed, pumped to a storage area, thickened, then treated for disposal.

Biological secondary treatment follows primary sedimentation. Organic material is removed from the wastewater by an aerobic biological process. Microorganisms (bacteria, algae, protozoa, fungi, etc.) consume the organic matter in the wastewater. After biological treatment, the wastewater flows into secondary sedimentation tanks for further settling of suspended solids and sludge removal.

/c/ When Southeast WPCP capacity exceeds 140 mgd, secondary treatment systems are bypassed and wastewater is treated at a primary level up to 210 mgd.

SOURCE: San Francisco Clean Water Program and Environmental Science Associates, Inc.

SOLID WASTE DISPOSAL

The basis for the future solid waste estimates for the Mission Bay was a solid waste projection equation for the Project Area prepared by Robert Crow, Chief Energy Engineer, Bechtel Power Corporation. This equation in turn was derived from an equation developed in the Forecast of Refuse Produced by the City of San Francisco by the Bechtel Power Corporation as part of a future solid waste study prepared for the San Francisco Chief Administrative Officer:

San Francisco Solid Waste =
(2.4 tons/year x San Francisco Population)+(0.9 tons/year x San Francisco Employment) - 1,617,000 tons

The 1,617,000-ton figure is a correction to account for existing solid waste generation.

Mission Bay Solid Waste =
(2.4 x Mission Bay Population)+(0.9 x Mission Bay Employment) - R(MB)

R(MB) is an estimated regression intercept term for the Project Area based on the ratio of the Project Area's population and employment to San Francisco's total population and employment. Its purpose is to estimate the difference between the actual amount of solid waste generated in the Project Area in 1985 and the amount estimated by the first two terms of the equation.

ESA modified the latter equation to produce a more accurate projection for the Project Area. The modification was the replacement of the term R(MB) with the difference between the actual amount of solid waste generated in the Project Area in 1985 and the amount estimated by the altered Bechtel equation produced a constant term for the ESA equation.

The final equation, estimating Mission Bay's solid waste in tons per year, is:

Mission Bay Solid Waste =
(2.4 x Mission Bay Population)+(0.9 x Mission Bay Employment) + 5,210

The projections of solid waste production in Mission Bay and San Francisco for 1985, 2000 and 2020 are presented in Table XIV.D.38.

TABLE XIV.D.38: PROJECT AREA AND SAN FRANCISCO SOLID WASTE ESTIMATES, 1985, 2000 AND 2020 (Thousand Tons per Year)

	1985	2000 Alternative			2020 Alternative		
		A	B	N	A	B	N
Mission Bay Solid Waste							
Population/a/	.09	13.07	12.12	.09	34.57	44.82	.09
Employment/b/	1.80	8.95	4.66	6.41	22.50	5.62	15.53
Calibration/c/	5.21	5.21	5.21	5.21	5.21	5.21	5.21
TOTAL	7.10	27.23	21.99	11.71	62.28	55.65	20.83
San Francisco Solid Waste	688.00	918.00	916.00	910.00	1,092.00	1,096.00	1,059.00
Mission Bay as a Percentage of San Francisco Solid Waste	1.0%	3.0%	2.4%	1.3%	5.7%	5.1%	2.0%

/a/ 2.4 tons of solid waste per person per year, multiplied by population in Table V.7, p. V.39.

/b/ 0.9 tons of solid waste per person per year, multiplied by employment in Table V.6, p. V.35.

/c/ Calibration adjusts equation based on 1985 solid waste data for the Project Area.

SOURCE: E.M. Rose and Associates and Environmental Science Associates, Inc.

APPENDIX E. TRANSPORTATION

INTRODUCTION

This appendix contains descriptions and discussions of the major assumptions and procedures used in the Mission Bay EIR to analyze different transportation modes. The descriptions and discussions are presented in the order in which a particular topic or issue is presented in Chapter VI.E. Transportation Setting, Impacts and Mitigation in the EIR.

The primary purpose of this appendix is to explain the methodologies used, and where necessary describe aspects of the travel forecasts or other procedures used in the transportation analysis that were not described in detail in the presentation of impacts. Inputs to, and outputs from, the analysis are located in data binders available for public review at the San Francisco Department of City Planning, Office of Environmental Review, 450 McAllister Street, San Francisco, California 94102.

EXISTING FACILITIES AND SERVICES

Descriptions of existing facilities and services are based on information sources described in the EIR text and footnotes. The following types of information sources were used:

- Technical memoranda, planning studies, Environmental Impact Reports and Environmental Impact Statements, and regional and local transportation and transit plans.

- Counts of vehicular volumes on roadway segments and at intersections, of transit riders, pedestrians, parking use, and bicyclists.

- Data describing rail freight carloading trends and frequencies of opening of the Third and Fourth Street Bridges.

TRAVEL FORECASTING APPROACH AND METHODOLOGY

Introduction

The analysis of future travel demand by mode at regional screenlines and of Levels-of-Service at intersections within and adjacent to the Project Area required a variety of data sources for forecasting of future travel. Specific information, not all available from the same source, was needed to relate travel behavior and demand for trips destined to or from the Mission Bay Project Area, Downtown & Vicinity, the rest of San Francisco, and the rest of the region. To create the travel forecasting models, travel data for 1980 and 1985 were used to refine the parameters incorporated into the models to simulate p.m. peak travel patterns.

Travel simulations were created for both inbound and outbound trips, for the Downtown & Vicinity and the rest of the region, during the p.m. peak period and p.m. peak hour. Two linked models were used to estimate screenline (cordon) volumes and intersection turning movement volumes. Those models used input parameters, such as geographic distribution, mode choice, and peaking factors to generate estimates of peak-period and peak-hour person and vehicle trips. The primary sources for the model inputs were surveys conducted by Recht Hausrath & Associates (RHA) and the Metropolitan Transportation Commission (MTC).

The screenline model was used to simulate travel demand crossing three "regional" screenlines surrounding San Francisco, and four screenlines within the City, surrounding

Downtown & Vicinity. The model output includes peak-period and peak-hour estimates of trips by mode of travel that would cross each screenline, based on the geographic distribution of place-of-residence of employees or place-of-work of employed residents and on peaking characteristics defined for each mode of travel. Screenlines are shown on Figure XIV.E.1.

The intersection model was used to simulate and forecast vehicle trips traveling through specific intersections in Downtown & Vicinity during the peak period and peak hour. The intersection model used, as an input, the vehicle trip estimates generated by the screenline model. The assignments created by the intersection model reflect the alternative paths or routes available to vehicle drivers within and adjacent to the Project Area. The most detailed model output consists of vehicle turning movements for key intersections in the Project Area and freeway access points.

Two simulations and two future-year travel demand forecasts were produced during the preparation of the environmental impact analysis. The 1980 and 1985 simulations were used for model calibration, while the 2000 and 2020 travel demand forecasts were used to evaluate future travel impacts.

Screenline Travel Demand Model

The screenline model consists of six spread sheet "tables" that calculate travel demand based on direction and trip type for the p.m. peak period and p.m. peak hour. Three trip types are defined as occurring in both the inbound and outbound directions at each screenline. The three trip types are home-based-work (HBW), home-based-other (HBO), and non-home-based (NHB) trips.

There are six primary steps in the creation of each trip "table." Those steps and the order in which they occur are shown in Figure XIV.E.2, p. XIV.E.4, and are described briefly below:

- Trip Base -- number of employees used for outbound trips and number of employed residents used for inbound trips./1/

- Conversion Factors -- factors that convert the trip base to either home-based-work, home-based-other, or non-home-based trips using MTC's travel forecasting parameters.

- Geographic Distribution -- factors that mathematically distribute the cumulative trips for each of the three trip purposes to five areas of San Francisco and to the three regional screenlines./2/

- Peaking and Mode Split -- factors that assign person trips within a specific geographic area to all available travel modes. Each mode is assigned a peak-period and peak-hour factor that represents the number of persons traveling within the p.m. peak-period and peak hour, respectively.

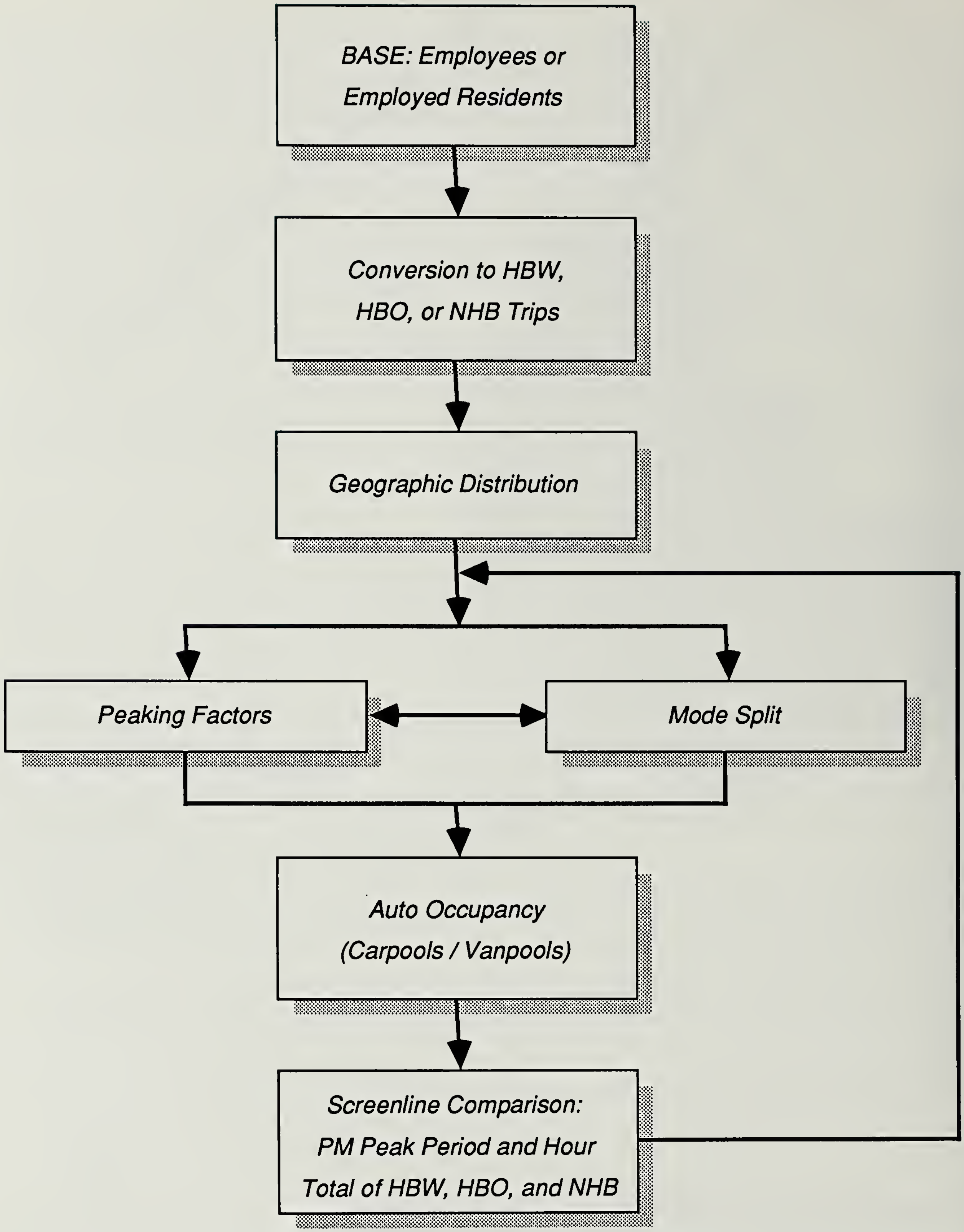
- Vehicle Occupancy -- factor applied to carpool and vanpool person trips to convert them to vehicle trips. These factors vary by geographic area.

- Calibration -- the comparison of the sum of 1980 and 1985 HBW, HBO, and NHB trips to vehicle counts and to transit ridership estimates at each of the four downtown and three regional screenlines. Calibration of the factors comprising the screenline travel model was accomplished by adjusting the peaking and mode choice factors within each geographic corridor and at each screenline.

Mission Bay

FIGURE XIV.E.1
MUNI AND REGIONAL SCREENLINES

SOURCE: Barton-Aschman Associates, Inc.



Mission Bay

FIGURE XIV.E.2
STEPS IN THE DEVELOPMENT OF THE SCREENLINE TRAVEL FORECASTING PROCESS

SOURCE: Barton-Aschman Associates, Inc.

Use of Survey Information

The two primary sources of travel characteristics used in the development of the model factors were the 1981/1982 Downtown and South of Market / Folsom Employer/Employee Surveys by Recht Hausrath & Associates (RHA) and the 1981 Regional Household Survey by the Metropolitan Transportation Commission (MTC). RHA's surveys were conducted for a sample of business activities in downtown San Francisco, while MTC's survey was conducted for a sample of households within the nine-county region. (It should be noted that approximately 50% of the households in the MTC sample survey were located in San Francisco.)

A comparison of the results of those surveys produced a set of guidelines that were used to develop the 1985 travel characteristics (e.g. mode choice, time of travel) for employees in Downtown & Vicinity. In order to compare the two surveys' responses to travel-related questions, it was necessary to review the definitions of each survey's response characteristics to insure that a direct comparison was reasonable. In some cases, a combination of factors from one survey was compared to a single factor or combination of factors from the other survey. The comparison of survey products is presented in Table XIV.E.1. An example of comparison of multiple factors to a single factor occurred in the development of an employee absenteeism rate. MTC developed a single absenteeism rate, based on travel logs maintained by survey respondents that accounts for vacations, business travel and illness. In the RHA survey results, it is necessary to combine the responses to several questions to develop an analogous absenteeism rate.

The MTC survey included approximately 1,000 households outside of the City/County of San Francisco; therefore, the MTC Household Survey accounts for regional travel characteristics, as well as for characteristics of travel to, from and within San Francisco. Since the RHA surveys were of employees of the C-3 district and South of Market area in Downtown & Vicinity, the MTC survey data were used as the primary guidelines in the estimation of trips from elsewhere in the region.

Geographic boundaries or zone systems constituted another important element in the comparison of the two survey results. The RHA survey defined fifteen geographic areas, including some in Downtown & Vicinity and some in the rest of the region. The MTC data were available in two levels of detail -- the 550-zone level and the 34-super-district level. To compare the survey results, a third level was created that aggregated MTC's 550-zone data into a 15-zone system comparable to the RHA zone system.

Travel Forecasting Process

The travel forecasting process contains four steps -- trip generation, trip distribution, mode choice, and trip assignment.

- Trip generation consists of estimating the number of person trips made from one area to another.
- Trip distribution consists of estimating the connection between trips made from one area and trips made to all other areas in a region or part of a region.
- Mode choice consists of allocating the total person trips made from one area to another to the modes of travel available between the two areas.
- Trip assignment consists of allocating each mode's trips to each path or route available.

TABLE XIV.E.1: LISTING OF SURVEY PRODUCTS USED TO GENERATE MISSION BAY TRAVEL MODEL

Factor	San Francisco Employee Surveys (by RHA)	Regional Household Survey (by MTC)
Survey Basis	Employees, Employers (at place of work)	Residents (at household)
Survey Results	Employment (jobs, workers)	Trips (work-related travel)
Time Period Represented	Usual travel behavior, no specified time period	Behavior on day of survey (i.e., a typical day)
Survey Results Include:	Full and part-time workers in C-3 and South of Market areas	Primary work, secondary, work, and work-related trips for households throughout the region
Primary Tripmaker	Employees	Members of households
Absenteeism Rates Account for:	Vacations; holidays, sick leave, work anywhere but in study area	Holidays
Travel Distribution	Places where (study area) employees reside	Places where work or work-related trips started and ended.
Time of Travel	Time worker usually leaves work	Typical time of day for work trips
Primary Mode	Mode usually taken from work (at screenline)	Mode used for typical day's trip(s) (at screenline).

SOURCE: Barton-Aschman Associates

Trip Generation

In traffic impact analyses, trip generation is based conventionally on the type of land use and a unit element such as square footage of development or the number of dwelling units. An alternative trip generation approach, used in transportation planning, consists of estimating trips on the basis of the number of employees or employed residents in a particular land use or travel zone. The latter approach was used recently in the Downtown Plan EIR (EE81.3, certified October 1984).

The screenline model was designed to produce p.m. peak-period and p.m. peak-hour travel estimates. Therefore, outbound home-based-work trips were estimated on the basis of the number of employees working in Downtown & Vicinity. Inbound home-based work trips were estimated on the basis of the number of employed residents living in Downtown & Vicinity.

Two factors were developed to convert the number of employees or employed residents (forecast by RHA) to home-based-work trips (forecast by MTC). The factors account for employee absenteeism and for non-home-based work trips (e.g., for work-related trips not made directly from work to home).

In order to estimate total trips, it was necessary to develop estimates for the two other trip types -- home-based-other and non-home-based. Since the RHA survey results contained no information that would define a relationship between home-based-work trips and the other two trip types, MTC's survey results and MTC's regional travel model outputs were used to create the mathematical connection between home-based-work trips and home-based-other or non-home-based trips.

Home-Based-Work Trips. To develop a factor or set of factors to convert the number of employees to home-based-work trips, it was necessary to define clearly the relationship between an employee and a home-based-work trip. The RHA surveys represent the number of employees that should be at work in the survey areas. However, on any given work day, some portion of the employees will be absent from work for one of the following reasons: vacation, sick leave, or work away from the office (travel outside the study area).

An absenteeism factor of 0.889 was developed from the responses to RHA's survey question regarding the frequency of an employee's absence from work for illness, vacation, business, or personal activities. The responses indicated that, on an average day, approximately 11% of the employees were away from their regular place of work.

A home-based-work trip is defined as one part of a round-trip journey (two trips) that would be made from home to work and from work to home. This trip purpose must represent a direct trip between work and home without intermediate stops. An intermediate stop would place the trip into one of the two other trip types -- home-based-other (a trip to/from home from/to any place but work) or non-home-based (a trip to or from any place that is not home). Therefore, in conversion of total numbers of employees to home-based-work trips, the conversion factor has to be less than one to account for other types of work-related trips.

An additional conversion factor of 0.865 was calculated to proceed from the number of employees (present at the work site) to home-based-work trips. This factor was derived by dividing RHA's 1980 employment estimates (adjusted for absenteeism) by MTC's estimate of 1980 home-based-work trips for a similar area of Downtown & Vicinity. Therefore, the formula for converting Downtown & Vicinity employees to home-based-work trips is as follows:

Home-Based-Work Trips = Employees x Absenteeism Factor x Conversion Factor
= Employees x 0.889 x 0.865 = Employees x 0.769

Home-Based-Other and Non-Home-Based-Trips. MTC's 1980 super-district data were used to estimate the number of home-based-other and non-home-based trips generated by the activities in Downtown & Vicinity. Those trip-making relationships were held constant over the years and across the EIR Alternatives. Therefore, the numbers of home-based-other and non-home-based trips change only in proportion to the number of employees or employed residents in Downtown & Vicinity, depending on whether p.m. peak outbound or inbound trips are being simulated.

Trip Distribution

RHA has prepared estimates of the geographic distributions of place of residence for employees of Downtown & Vicinity and place of employment for employed residents of

Downtown & Vicinity. Similar estimates are available from MTC's travel surveys and simulations. As mentioned earlier, MTC's 550-zone data were used as a secondary source for comparing and refining distributions of inbound and outbound home-based-work trips to and from Downtown & Vicinity during the peak hours. The 1980 geographic distribution of home-based-work trips was developed primarily from the responses to the downtown employer/employee surveys by RHA, which are very similar to MTC's geographic distribution of work-related trips from Downtown & Vicinity. Since the RHA surveys contained no information on the distribution of other trip types, MTC's survey results were used for the geographic distribution of home-based-other and non-home-based trips.

Peaking Factor

The RHA surveys included a question regarding the time an employee left work. The responses to this question provide indirect information on the number of employees traveling during the p.m. peak period and hour, as departure time from work is not the same as the time a person crosses a given screenline. This is particularly true at the regional screenlines located some distance from the Downtown & Vicinity.

Respondents to the RHA surveys were asked to identify their mode of travel to work (including carpools and vanpools) and to specify the carrier, if they used transit. Therefore, it was possible, by use of the survey responses, to determine the shares of modes used (mode split), and a cross-tabulation of responses made it possible to identify to what extent each mode of travel was used during the p.m. peak hours (to determine peaking factors by carrier). It was also possible to develop peaking factors for trips made by persons driving alone and for persons traveling in carpools and vanpools.

The MTC travel model, unlike the RHA survey responses, contains only three mode choice categories: vehicle (auto), transit and other. The "other" category includes trips made by walking, on bicycles or in school buses. Each mode category has specific regional peaking factors. Those generalized peaking characteristics were used to supplement the more detailed data derived from the RHA surveys for p.m. peak-period and p.m. peak-hour factors.

Modal Split

As in the case of peaking factors, the generalized MTC mode split factors served as guidelines, while the RHA factors were used to develop the mode splits for specific carriers within each geographic region. For some of the geographic areas, the MTC survey data could be compared directly to the RHA survey responses; i.e., if only one carrier provides service to the geographic area. An example would be Golden Gate Transit, which is the only regional transit carrier providing service from San Francisco to Marin and Sonoma Counties.

Calibration / Comparison with Existing Travel

The screenline model was calibrated against existing 1980 and 1985 counts at each of the four screenlines around Downtown & Vicinity and three regional screenlines around San Francisco. Since trip generation estimation is carried out for each of the three trip types (HBW, HBO, and NHB), it was necessary to calibrate to the 1980 MTC model run that contains all three trip types. Calibration of travel at the screenlines within San Francisco focused on MUNI ridership, while calibration of travel at regional screenlines included both vehicle trips (auto) and transit ridership.

The seven screenlines are used to measure trips into or out of the following seven areas of San Francisco and the region.

San Francisco Screenlines (MUNI Only)

- Northeast -- trips to the area north of Downtown & Vicinity and east of U.S. 101;/3/

- Northwest -- trips to the area west of U.S. 101, north of Lincoln Way and Oak Street;

- Southwest -- trips to the area south of Lincoln Way and Oak Street west of Dolores Street, San Jose Avenue and I-280; and

- Southeast -- trips to the area south and west of the Mission Bay Project Area, south of U.S. 101 (skyway), and east of Dolores Street, San Jose Avenue and I-280.

Regional Screenlines

- North Bay (Golden Gate) -- all trips to Marin and Sonoma Counties via Golden Gate Transit buses or ferries; private vehicles; or other modes, such as Red and White Fleet ferries.

- East Bay (Transbay) -- all trips to Alameda, Contra Costa, Napa and Solano Counties via BART or AC Transit; private vehicles; or other modes, such as charter buses.

- South Bay (Peninsula) -- all trips to San Mateo and Santa Clara Counties via BART, CalTrain, SamTrans, private vehicles, or other modes.

Calibration Methodology. The transit ridership data used for calibration were provided by the various carriers serving Downtown & Vicinity. MUNI provided data for each of the downtown screenlines, BART for the East Bay and South Bay screenlines, SamTrans and CalTrain for the South Bay Screenline, AC Transit for the East Bay Screenline, and Golden Gate Transit for the North Bay Screenline. Barton-Aschman adjusted some of the data to provide consistent counts for 1980 and 1985.

The calibration of auto traffic was done at the three regional screenlines, using traffic volume data provided by Caltrans and the Golden Gate Bridge District, and counts taken by Barton-Aschman. Both the Golden Gate and Bay Bridges have ongoing traffic count programs at the toll booths. The most detailed counts available represent a.m. peak conditions. For purposes of calibration, outbound traffic in the p.m. peak was assumed to be similar in magnitude to a.m. (inbound) peak traffic, except where (less reliable) p.m. peak counts were available for the two bridges.

For the U.S. 101 / I-280 screenline at the San Mateo County line, annual traffic volume data from Caltrans were used initially as the control for calibration. Caltrans' annual traffic volume reports provide estimates of peak-hour traffic volumes, as well as of daily traffic volumes. The Caltrans count program uses a set of control stations to establish annual growth factors for the traffic volumes between successive pairs of interchanges along a State Route. During the process of calibration, it was decided that new ground counts were needed for the screenline at the San Mateo County line, to verify the volumes reported by Caltrans. The new ground counts by Barton-Aschman were used to complete the 1985 calibration of traffic assigned to U.S. 101 and I-280 at the South Bay screenline.

The goal of the calibration effort was to adjust the model parameters so that the percent of Downtown & Vicinity trips represented a reasonable share of the total trips at each screenline location. Since home-based-work trips represent the greatest portion of all

peak-period trips and the greatest amount of survey data was related to work trips, the calibration effort focused on home-based-work trips. Once the the home-based-work trips represented a reasonable share, the other trip types were estimated and combined with the home-based-work trips to form total trips. The relationship of home-based-work trips to total trips was not changed from the MTC survey data. Total trips from Downtown & Vicinity were then compared to the traffic volumes (auto) or person trips (transit) at each screenline.

The basic steps of the calibration process were as follows:

- Compare HBW trips modeled to screenline counts by mode.

- Adjust primarily the mode split, and less so the peaking factors so that percentages of HBW trips modeled for each screenline would represent less than 100% of total transit.

- Add the HBO and NHB trips to the (modified) HBW trips to develop estimates of total trips from Downtown & Vicinity crossing screenlines.

- Compare estimated trips to actual screenline totals.

- Adjust the mode split, peaking and geographic factors for one or all the trip types until the percentages are reasonable for Downtown & Vicinity's contribution of trips to each screenline. (The primary adjustments were to HBW trips, as two data sources were available for this type of travel and HBW trips account for the large majority of peak period trips.)

As the calibration proceeded, it was necessary to make adjustments to several input elements in order to achieve results that would reasonably reflect the 1980 and 1985 counts. The factors listed below appear in the order in which they were modified during the calibration process:

- peaking factors (percent of daily travel in peak period and peak hour),
- mode split within a corridor, and
- geographic distributions.

The following paragraphs describe why modifications were required and how they were developed.

Early in the calibration of the 1980 simulation, several iterations were performed to determine the sensitivity of the model factors. On the basis of those initial results, it was decided to use separate peaking factors by mode rather than a single peaking factor for all modes. The peaking factors used to simulate p.m. peak transit travel did not vary significantly from RHA's survey results. However, it was not possible to calibrate p.m. peak period auto trips with the RHA survey factors, and MTC's peaking factors for autos provided significantly better results. MTC's auto peaking factors are approximately half of the original RHA factors. This change reflects the difference between the time when employees driving from Downtown & Vicinity leave their place of work and the time when they cross a regional screenline.

The greatest variation from RHA's survey results is in the mode splits, as it was not possible to achieve reasonable calibration by direct use of the RHA data. (The most likely reason for this is the RHA survey question that asked for the <u>usual</u> method of transportation, not for the <u>primary</u> mode actually used during the day of the survey.) Therefore, it was necessary to vary the mode splits between transit and auto users by

using MTC's transit-to-auto mode split relationships as guidelines for shifting persons between transit and autos. Once reasonable relationships were established, shifts were made between transit carriers or between drive-alone and carpool (modes) to complete the calibration.

Changes to the geographic distribution factors were considered only as a last resort in the calibration process. When it was impossible to calibrate by modifying the peaking or mode split factors, some trip distributions were changed between geographic corridors. The need for this adjustment was limited, however, and the home-based-work trip geographic factors used remain close to the original RHA distributions. Distributions of trips from Downtown & Vicinity changed primarily across two screenlines - northeast and southeast San Francisco - to reflect the change in the definition of the area within Downtown & Vicinity, now substantially larger than when the RHA surveys were done. (The geographic factors for the other trip types reflect the distributions from MTC's travel model.)

In summary, the screenline model was calibrated with data for 1980 and 1985. The initial calibration was completed on the basis of 1980 and 1981 employment, population, and travel statistics from RHA and MTC, and highway and transit counts. The calibration process continued by use of 1985 employment and population estimates from RHA and the Association of Bay Area Governments (ABAG), and highway and transit counts. In effect, the 1985-calibration effort represented the first application of the screenline model and indicated that very few changes were needed for the geographic distribution, mode split and peaking factors developed during the course of the 1980-calibration effort.

Results of the 1985 Simulation of Travel

Some of the characteristics of 1985 travel estimated from the application of the screenline travel model are presented in the EIR text, to allow for direct comparison of conditions in 1985, 2000 and 2020. This section presents additional results of the travel simulation for 1985, which explain the more detailed characteristics of travel by trip purpose.

Outbound Travel. In 1985, approximately 57% of the home-based-work trips produced (outbound) in the Downtown & Vicinity ended in San Francisco County. The remaining 43% of the home-based-work trips were destined from Downtown & Vicinity to counties outside of San Francisco. The distribution of trips to the four sections of San Francisco and the three portions of the Bay Area for 1985, 2000, 2020 is shown in Table XIV.2.

The distribution of home-based-other trips varies considerably from that of home-based-work trips because persons generally travel far shorter distances to go shopping, attend school, or visit friends than they do to get to work. That is why an estimated 22% of the home-based-other trips made from Downtown & Vicinity during the p.m. peak period are made by residents of that area. Approximately 77% of the home-based-other trips made from Downtown & Vicinity during the p.m. peak period were estimated to be made by residents of San Francisco, with the remaining 23% made by residents of other counties in the region.

Non-home-based trips generally cover shorter distances than home-based-other trips since the former typically are made between work or other non-home locations and the nearest activity, such as shopping, banking or eating, reachable in a short time period. Accordingly, about 50% of the non-home-based trips made by travelers residing outside Downtown & Vicinity were estimated to occur entirely within that area. Another 24% of the non-home-based trips were estimated to be destined to northeast San Francisco, plus

TABLE XIV.E.2: P.M. PEAK-PERIOD PERCENTAGES OF OUTBOUND TRAVEL FROM DOWNTOWN & VICINITY, 1985, 2000 AND 2020/a/

	Trip Purpose/b/										
	Home-Based-Work/b/									Home-Based-Other 1985, 2000 and 2020	Non-Home-Based 1985, 2000 and 2020
	1985	2000		2020							
Screenline		/c/	% Change from 1985	Alt. A	% Change from 1985	Alt. B	% Change from 1985	Alt. N	% Change from 1985	/c/	/c/
Within /e/	3.6	4.5	25	5.5	53	6.0	67	4.3	19	22.0	50.0
SF Northeast	6.5	5.9	-9	5.6	-14	5.7	-12	5.7	-12	10.9	24.0
SF Northwest	15.2	12.8	-16	12.3	-19	12.5	-18	12.6	-17	20.4	7.1
SF Southeast	12.0	10.2	-15	9.7	-19	9.8	-18	10.0	-17	17.5	6.0
SF Southwest	20.0	16.5	-18	15.6	-22	15.8	-21	15.9	-21	5.8	1.1
North Bay	6.8	7.4	9	7.9	16	7.6	12	7.9	16	8.4	3.4
East Bay	23.3	29.8	28	29.8	28	29.7	27	29.9	28	13.8	3.8
South Bay	12.6	12.9	2	13.6	8	12.9	2	13.7	9	1.2	4.6
Total	100.0	100.0		100.0		100.0		100.0		100.0	100.0

/a/ The same geographic distributions apply to p.m. peak period and peak hour trips.
/b/ See Appendix E. p. XIV.E.7 for the definitions of these three trip purposes.
/c/ The same geographic distributions of trips from Downtown & Vicinity apply to the three Mission Bay Project Area Alternatives, and are not forecast to change from 1985.
/d/ Change between 1985 and 2000 or 1985 and 2020 in the share of total Downtown & Vicinity trips projected to be made to each area; does not represent change between 1985 and 2000 or 1985 and 2020 projected in the number of trips made from Downtown & Vicinity to an area.
/e/ These trips do not cross a screenline, but remain within the cumulative study area.

SOURCE: Barton-Aschman Associates, Inc. Based on place-of-residence distributions developed by Recht Hausrath & Associates, and regional travel distributions developed by MTC.

14% to the other parts of San Francisco. Only about 12% of the non-home-based trips are estimated to be made from downtown San Francisco to other parts of the region during the p.m. peak period.

Inbound Travel. Analysis of the MTC travel data and of responses to a sample survey of downtown residents conducted in 1986 by Recht Hausrath and Associates and Barton-Aschman Associates, Inc. indicates that approximately 65% of the home-based-work trips made by residents of Downtown & Vicinity also end there. About 21.5% of the home-based-work trips made by residents of Downtown & Vicinity are made to and from other areas of San Francisco, while the remaining 13.5% are made to and from other parts of the region.

Because of the residents' primary motivation for living there, very high percentages of the home-based-other (63%) and non-home-based trips (66%) made by residents of Downtown & Vicinity also end there. Approximately 31% of the home-based-other trips made by residents of Downtown & Vicinity are made to and from the rest of San Francisco, while only about 6% are made to and from other parts of the region.

Outbound and Inbound Travel. In 1985, San Francisco's Downtown & Vicinity was estimated to produce 202,000 one-way outbound trips during the 4:00 to 6:00 p.m. peak period and 117,000 one-way outbound trips during the 4:30 to 5:30 p.m. peak hour, by persons who do not live there, but who travel there for work, shopping, school, recreation, or other purposes. The 4:00 to 6:00 p.m. peak period contained about 37% and the 4:30 to 5:30 p.m. peak hour contained about 21% of the daily one-way trips made outbound from the Downtown & Vicinity by such travelers. The number of daily outbound trips for such travelers was 552,000, or 1,104,000 trips inbound and outbound. These estimates of one-way trips are based on 1985 employment estimates by Recht Hausrath and Associates and 1980 regional travel data from MTC updated by Barton-Aschman to reflect 1985 regional employment and population levels.

During the 4:00 to 6:00 p.m. peak period of travel, the three trip purposes are estimated to represent the following percentages of total travel:

	For Trips Outbound From Downtown & Vicinity	For Trips Inbound To Downtown & Vicinity
Home-based-work	81%	43%
Home-based-other	9%	24%
Non-home-based	10%	33%

During the p.m. peak period, home-based-work trips are a far larger percentage of outbound trips than of inbound trips (81% vs. 43%) because at that time of day there are far more workers leaving Downtown & Vicinity than there are employed residents returning to their homes in that area. During the p.m. peak period, the percentages of home-based-other (24% vs. 9%) and non-home-based trips (33% vs. 10%) are much higher in the inbound direction simply because the percentage of home-based-work trips is lower inbound than outbound.

Intersection Assignment Model

General Description

The intersection assignment model consisted of two primary steps. The first step generated an auto trip table that is common to the analysis of each critical intersection. The second step developed a set of assignments to convert zone-to-zone trips into

forecasts of turning movements at individual intersections. (Specifically this analysis for Downtown & Vicinity was represented by ten traffic analyses zones (TAZ), and the rest of the region by ten zones.) During the calibration process, the trips estimated by the intersection assignment model were compared to actual traffic counts. Those steps included the following more detailed components:

- Auto Trip Table -- The auto trips generated by the screenline model were combined with regional forecasts of auto travel to develop a trip table that defined the auto trips affecting each intersection included in the analysis. Distribution factors were used to subdivide trips to and from Downtown & Vicinity into trips to and from traffic analysis zones.

- Assignment Paths -- Paths or sets of paths were developed for each zone pair within the trip table. A percentage of the total trips traveling between the zones was assigned to each path. By use of those assignment paths and the related percentages, the assigned trips were calculated and loaded onto the network at the appropriate intersections.

- Calibration -- Once the 1985 assignment was completed, simulated intersection volumes were compared to actual 1985 intersection turning movement counts. On the basis of this comparison, adjustments were made to the percentages incorporated into the assignment paths until the estimated volumes resembled the existing traffic counts.

Auto Trip Table

The auto trip table used the trip data generated by the screenline model as the primary input to determine the number of p.m. peak hour trips to and from Downtown & Vicinity and the rest of the region, and within Downtown & Vicinity. The trip table was designed to break to or from Downtown & Vicinity trips into trips to and from ten traffic analysis zones. Trips were assigned to individual zones, based on the number of employees or employed residents within each zone. Those allocations were done on the basis of estimates prepared by RHA.

Trips outbound from Downtown & Vicinity were assigned to each zone on the basis of the percent of employees of Downtown & Vicinity working within each zone. Trips inbound to Downtown & Vicinity were assigned on the basis of the percentage of employed residents of Downtown & Vicinity living in each zone. Trips between Downtown & Vicinity zones were assigned on the basis of the percent of Downtown & Vicinity's employed residents of Downtown & Vicinity in a zone, multiplied by the percent of employees Downtown & Vicinity in another zone.

In addition to calculating auto trips to or from Downtown & Vicinity, the auto trip table required additional inputs regarding characteristics of auto travel between selected regional zone pairs that would affect surface streets within Downtown & Vicinity. Because of the configuration of the freeway interchanges in the Downtown & Vicinity, some regional trips occur on arterial streets. An example of this type of trip would involve persons traveling from San Mateo to the East Bay using I-280 and I-80. For a limited portion of their trip, those travelers would use surface streets between the I-280 off-ramps and the I-80 (bridge) on-ramps. MTC's trip tables were used to estimate the number of trips between areas of the region. MTC's 34-super-district data were aggregated to estimate regional tripmaking patterns. Travel forecasts for each of the three trip types were factored to reflect p.m. peak period travel and were then added

together to develop estimates of total trips for each regional origin-destination group. Those estimates were used to represent regional traffic affecting the local roadway network.

Assignment Paths

On maps, one or more travel routes (paths) were defined for each interchange, for trips that would affect intersections in Downtown & Vicinity. Since it was possible to assign multiple paths between two zones, indirect routes were identified that could be used to avoid congested direct routings. Those indirect paths typically take advantage of surface street connections around intersections affected by congestion. Paths were defined by direction so that they reflected the one-way street system and provided the opportunity to select different inbound vs. outbound travel routes.

Each travel path was assigned a percentage of total auto trips between origin and destination zones or areas of the region. Depending on the interchange of trips involved, anywhere from 1 to 100% of the trips would be assigned to a given path through Downtown & Vicinity. Origin/destination zones in the center of Downtown & Vicinity would have 100% of their traffic assigned to some travel paths, while origins or destinations on the periphery of Downtown & Vicinity or in the rest of the region would have only a small percentage of their trips traveling through the specified intersections.

Calibration

Each intersection was calibrated by means of peak-period and peak-hour turning movement counts taken in 1985. Once the initial assigned paths were entered into the model, a review of all intersections was conducted to define whether travel patterns were accurately modelled. All intersections needed to be reviewed in each iteration, as a change in the assignment at one intersection affects the assignment of traffic at nearby intersections.

During the first set of iterations, total intersection volumes were used to establish order-of-magnitude changes in assignment paths. In the second set of iterations, both turning movements and total volumes were used to refine the assignment percentages to reflect turning-movement counts. The calibration was terminated when the estimated intersection turning volumes were within five percent of the actual turning movement counts.

Each iteration required adjustments to the assignment paths. In review of the paths, alternative routes were considered, as well as modification of the distribution of traffic using the existing routes. When changes were made at one intersection, changes were carried out throughout the roadway network. To create substantial changes at some intersections, it was necessary to focus on the interchanges between zones that contained large numbers of trips.

Level of Service Calculations

Signalized Intersections. At the request of the Department of City Planning, the Circular 212 Planning Method was used to calculate the levels of service for the intersections analyzed in the Mission Bay EIR./4/ This procedure defines the Level of Service (LOS) for signalized intersections, based on capacity. The analysis incorporates the effects of geometry and traffic signal operations in determining the LOS for the intersection as a complete operating unit.

The key assumption in this technique is that there is a combination of lane volumes that must be accommodated in 1 hour through the middle of the signalized intersection. The

sum of the approach volumes, termed "critical volume," cannot exceed the saturation flow characteristics of the intersection. In the Planning Method, the maximum critical volume for the intersection (in light pedestrian conditions) is based on a maximum intersection throughput of 1,500 passenger cars per hour (vph).

The Circular 212 planning methodology uses the measured volumes (from counts) and the lane geometry (identified from field surveys or roadway plans). A signal phasing plan for the intersection is used to determine critical volumes. The sum of the critical volumes (V) for each signal phase is calculated, and that sum is then compared with the maximum sum of critical volumes (C).

The results of the capacity calculations show the operating condition of an intersection by using a volume/capacity (V/C) ratio and an associated LOS. (The V/C ratio is the ratio of the hourly volume of traffic to the (saturation) capacity of the intersection.) The ratio can reflect accurately the derived LOS within one LOS. LOS gives a rating to the V/C ratios and provides an indication of the operating condition of an intersection. Table XIV.E.3 provides descriptions of the operating conditions at each LOS.

Two different methods were used to calculate the existing LOS at intersections, such as those at or near freeway on-ramps, whose capacity would be affected by capacity constraints on the freeway. At Second and Harrison Streets, the overall LOS was calculated by weighting the LOS calculated for each approach by each approach's volume and then summing. At other intersections whose throughput of vehicles is constrained by backups from the nearest freeway on-ramp, the maximum critical volume was redefined to be equal to capacity or that which would produce a V/C ratio of 1.0.

Unsignalized Intersections. As was done for signalized intersections, the Circular 212 Planning Method was used to calculate the LOS for the two major intersections not signalized in 1985. Detailed calculation sheets were used to derive the LOS based on lane geometry, number of lanes and the comparison of through and turning movements to identify the magnitude of conflicting movements.

Freeways. LOS for freeways are calculated by means of the same general procedures as for intersections, except that the capacity of a freeway segment is determined by the number of lanes multiplied by the capacity of each lane measured in vehicles per hour. Although the "design" capacity of freeway lanes is usually 1,800 vehicles per hour, the maximum throughput is typically 2,000 vehicles per hour. The relationships between freeway volume-to-capacity ratios and freeway LOS are shown in Table XIV.E.4. Those relationships were used to identify the LOS projected for the peak hour of travel.

Transit. A methodology to derive LOS on transit lines and routes was also included in Circular 212. The relationships between the ratios of passengers-per-seat and the LOS for all modes of transit are shown in Table XIV.E.5. As indicated in the text of the EIR, most transit operators do not use seats as the unit of measure for capacity, but instead use the concept of load factor.

When transit agencies adjust their schedules and move other service changes, they use load factor as the measure of vehicle occupancy based on passengers per seat. Transit agencies use maximum and minimum load factor standards, instead of the LOS categories described in Table XIV.E.6. Load factor standards denote the number of passengers that each transit agency expects to comfortably carry on each type of transit vehicle or type of service (e.g. local or express). Some load factor standards indicate that standees are expected, while others are not. For example, MUNI has determined that its average fifteen-minute load factor standards are 1.3 persons per seat on standard buses,

TABLE XIV.E.3: VEHICULAR LEVELS OF SERVICE AT SIGNALIZED INTERSECTIONS

Level of Service	Description	Volume/Capacity (v/c) Ratio/a/
A	Level of Service A describes a condition where the approach to an intersection appears quite open and turning movements are made easily. Little or no delay is experienced. No vehicles wait longer than one red traffic signal indication. The traffic operation can generally be described as excellent.	0.00-0.60
B	Level of Service B describes a condition where the approach to an intersection is occasionally fully utilized and some delays may be encountered. Many drivers begin to feel somewhat restricted within groups of vehicles. The traffic operation can generally be described as very good.	0.61-0.70
C	Level of Service C describes a condition where the approach to an intersection is often fully utilized and back-ups may occur behind turning vehicles. Most drivers feel somewhat restricted, but not objectionably so. The driver occasionally may have to wait more than one red traffic signal indication. The traffic operation can generally be described as good.	0.71-0.80
D	Level of Service D describes a condition of increasing restriction causing substantial delays and queues of vehicles on approaches to the intersection during short times within the peak period. However, there are enough signal cycles with lower demand such that queues are periodically cleared, thus preventing excessive back-ups. The traffic operation can generally be described as fair.	0.81-0.90
E	Capacity occurs at Level of Service E. It represents the most vehicles that any particular intersection can accommodate. At capacity there may be long queues of vehicles waiting up-stream of the intersection and vehicles may be delayed up to several signal cycles. The traffic operation can generally be described as poor.	0.91-1.00
F	Level of Service F represents a jammed condition. Back-ups from locations downstream or on the cross street may restrict or prevent movement of vehicles out of the approach under consideration. Hence, volumes of vehicles passing through the intersection vary from signal cycle to signal cycle. Because of the jammed condition, this volume would be less than capacity.	1.01+

/a/ Capacity is defined as Level of Service E.

SOURCE: San Francisco Department of Public Works, Traffic Division, Bureau of Engineering from Highway Capacity Manual, Highway Research Board, 1965.

TABLE XIV.E.4: VEHICULAR LEVELS OF SERVICE FOR FREEWAYS

Level of Service	Description	Volume/Capacity* (v/c) Ratio
A	Level of Service A describes a condition of free flow, with low volumes and high speeds. Traffic density is low, with speeds controlled by driver desires, speed limits, and physical roadway conditions. There is little or no restriction in maneuverability due to the presence of other vehicles, and drivers can maintain their desired speeds with little or no delay.	0.00-0.60
B	Level of Service B is in the higher speed range of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed and lane of operation. Reductions in speed are not unreasonable, with a low probability of traffic flow being restricted.	0.61-0.70
C	Level of Service C is still in the zone of stable flow, but speeds and maneuverability are more closely controlled by the higher volumes. Most of the drivers are restricted in their freedom to select their own speed, change lanes, or pass. A relatively satisfactory operating speed is still obtained.	0.71-0.80
D	Level of Service D approaches unstable flow, with tolerable operating speeds being maintained though considerably affected by changes in operating conditions. Fluctuations in volume and temporary restrictions to flow may cause substantial drops in operating speeds. Drivers have little freedom to maneuver, and comfort and convenience are low, but conditions can be tolerated for short periods of time.	0.81-0.90
E	Level of Service E cannot be described by speed alone, but repre sents operations at even lower operating speeds (typically about 30 to 35 mph) than in Level D, with volumes at or near the capacity of the highway. Operations in this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Even minor disruptions can produce a serious breakdown with extensive queuing.	-0.91-1.00
F	Level of Service F describes forced or breakdown flow at low speeds (less than 30 mph), in which the freeway acts as storage for queues of vehicles backing up from a restriction downstream. Speeds are reduced substantially and stoppages may occur for short or long periods of time because of downstream congestion. In the extreme, both speed and volume can drop to zero.	1.00+

* Capacity is defined as Level of Service E.

SOURCE: Environmental Science Associates, Inc. from information in the Highway Capacity Manual, Special Report 87, Highway Research Board, 1965.

1.65 persons per seat on articulated buses, and 1.8 persons per seat on light rail vehicles. The Circular 212 methodology would classify these load factor standards as LOS F. Although load factors differ among different vehicle types (e.g. light rail vehicles can accommodate more seated and standing passengers than articulated buses which in turn can accommodate more seated and standing passengers than standard buses), an overall standard of 1.25 persons per seat is used in this analysis to define acceptable LOS on MUNI. On the other hand, the Golden Gate Transit District uses a load factor standard of 1.0 on its express buses, because on those routes the District intends to provide a seat for every passenger. This would be the equivalent of LOS C.

Load factors are affected also by the variation in demand caused by seasonal and day-of-week travel fluctuations, service reliability, travel behavior, and characteristics of the travel corridor. Changes in those conditions affect the amount of travel occurring in different months of the year, on different days of the week, or during different hours of the day. The number of seats provided will also vary because of problems with schedule adherence, equipment breakdowns, traffic congestion or accidents, or other incidents. Thus, the passengers-per-seat ratios computed in this EIR analysis should be viewed not as occurring on every peak-period or peak-hour transit trip, but solely as indicative of the general LOS that can be expected at the screenlines. For example, the load factor on the most crowded BART train serving San Francisco in the p.m. peak period varies from 1.78 on the Fremont/Daly City line to 1.38 on the Richmond/Daly City line.

Pedestrian Circulation. Measurement of pedestrian activity is based conventionally on an average flow rate of pedestrians per foot of (effective) sidewalk width per minute (p/f/m). The rates, which vary from approximately 0.5 to greater than 18, have been divided into categories indicating the degree of congestion. The categories and the corresponding flow rates are shown in Table XIV.E.6.

The first flow category (or regime) is "Open." This regime indicates very light pedestrian activity with free choice of walking speed and no conflicts. The subsequent categories range from "Unimpeded" to "Impeded" to "Constrained" to "Crowded" to "Congested" and finally to "Jammed", with only shuffling movements possible and unavoidable conflicts.

Total sidewalk width is measured as the distance from curb to building; however, effective width is calculated by subtracting the width occupied by obstructions from the total width. Thus, a sidewalk with a total width of eight feet may have a much narrower effective width if trees, poles or other obstructions block part of the sidewalk. The calculation methodology consists of making counts of the total number of pedestrians moving in each direction past a specific point on a sidewalk in a specific period of time. The number of pedestrians per minute is calculated by dividing the number of pedestrians counted by the length of the count period (in minutes). The number of pedestrians per minute is divided by the effective width of the sidewalk where the count was made, to derive pedestrians per foot per minute, which can then be used as an indicator of operating conditions.

Moveable Bridges on China Basin Channel. Analysis of hourly data available for 1985 indicates that between 4:00 and 6:00 p.m. the Third Street Bridge was opened for boats about 17% of all weekdays (i.e., the bridge was not closed to vehicular traffic at all during the p.m. peak period on 83% of all weekdays). The Fourth Street Bridge was opened for boats approximately 9% of all weekdays during the p.m. peak period (i.e., that bridge was not closed to vehicular traffic at all during the p.m. peak period on 91% of all weekdays in 1985)./5/

TABLE XIV.E.5: PASSENGER LEVELS OF SERVICE ON BUS TRANSIT

Level of Service	Description	Passengers (v/c) Ratio/a/
A	Level of Service A describes a condition of excellent passenger comfort. Passenger loadings are low with less than half the seats filled. There is little or no restriction on passenger maneuverability. Passenger loading times do not affect scheduled operation.	0.00-0.50
B	Level of Service B is in the range of passenger comfort with moderate passenger loadings. Passengers still have reasonable freedom of movement on the transit vehicle. Passenger loading times do not affect scheduled operations.	0.51-0.75
C	Level of Service C is still in the zone of passenger comfort, but loadings approach seating capacity and passenger maneuverability on the transit vehicle is beginning to be restricted. Relatively satisfactory operating schedules are still obtained as passenger loading times are not excessive.	0.76-1.00
D	Level of Service D approaches uncomfortable passenger conditions with tolerable numbers of standees. Passengers have restricted freedom to move about on the transit vehicle. Conditions can be be tolerated for short periods of time. Passenger loadings begin to affect schedule adherence as the restricted as the restricted freedom of movement for passengers requires longer loading times.	1.01-1.25
E	Level of Service E passenger loadings approach manufacturers' recommended maximums and passenger comfort is at low levels. Freedom to move about is substantially diminished. Passenger loading times increase as mobility of passengers on the transit vehicle decreases. Scheduled operation is difficult to maintain at this level. Bunching of buses tends to occur which can rapidly cause operations to deteriorate.	1.26-1.50
F	Level of Service F describes crush loadings. Passenger comfort and maneuverability is extremely poor. Crush loadings lead to deterioration of scheduled operations through substantially increased loading times.	1.51-1.60

/a/ Capacity is defined as Level of Service E.

SOURCE: Environmental Science Associates, Inc. from information in the Interim Materials on Highway Capacity, Transportation Research Circular 212, pp. 73-113, Transportation Research Board, 1980.

TABLE XIV.E.6: PEDESTRIAN FLOW REGIMES

Flow Regime	Walking Speed Choice	Conflicts	Average Flow Rate (P/F/M)/a/
Open	Free Selection	None	0.0-0.5
Unimpeded	Some Selection	Minor	0.52
Impeded	Some Selection	Indirect Interaction	2-6
Constrained	Some Restriction	Multiple	6-10
Crowded	Restricted	High Probability	10-14
	Design Limit - Upper Limit of Desirable Flow		
Congested	All Reduced	Frequent	14-18
Jammed	Shuffle Only	Unavoidable	/b/

/a/ P/F/M = Pedestrians per foot of sidewalk width per minute.
/b/ For Jammed Flow, the (attempted) flow rate degrades to zero at complete breakdown.

SOURCE: Pushkarev and Zupan, Urban Space for Pedestrians.

The average delay to motor-vehicle traffic crossing China Basin Channel was estimated for the morning and evening peak periods by multiplying the duration of traffic delay by the probability that each bridge would be open in the specific hour. The derived values of delay per hour of clock time range from 0.08 minutes (4.8 seconds) on the Fourth Street Bridge during the morning weekday peak period, to 0.80 minutes (48 seconds) on the Third Street Bridge during the bridge's evening peak hour. During the p.m. peak period, traffic attempting to cross the Third Street Bridge is estimated to be prevented from doing so an average of 0.68 minutes per 60 minutes of clock time per weekday. Traffic attempting to cross the Fourth Street Bridge during the p.m. peak period would be delayed an average of 0.36 minutes per 60 minutes of clock time per weekday.

FUTURE TRANSPORTATION FACILITIES AND SERVICES

The development of Mission Bay will occur over a long period (about 30 years). It requires long-range planning that evaluates and recommends the types and magnitudes of infrastructure and services that would be needed to support the development program. The environmental analyses for Mission Bay therefore incorporate some assumptions about future transportation improvements. Those improvements are founded upon stated objectives and priorities established in transportation plans and policies for the Bay Area region. Based on improvements that have occurred in the past, it is reasonable to expect that transportation improvements will occur in the future.

The transportation improvements, defined as "reasonably assured capacity" increases, are assumed in the impact analyses for year 2000. They are not identified as being fully assured, because the various funding processes upon which they all rely are determined on an annual basis. A detailed discussion of the planning and priority setting process for regional transportation improvements is presented below.

Projects or proposals not specifically mentioned below are not included in the analysis of future travel conditions because those projects failed to meet the three criteria used to establish the likelihood of their availability by 2000, or are considered to have little or no impact on access to San Francisco or the Project Area. Transportation projects that have or will have minimal effect on accessibility to Downtown & Vicinity include those projects that are too far away, will provide additional capacity only to bypass short sections of congested roadways, or may not increase overall levels of transit service but may just shift riders from one transit mode to another.

The definition of the list of highway and transit facilities and services assumed to exist by 2000 is based on the formal transportation planning and programming process that already exists to determine priorities for funding capital projects, operations and maintenance. If this planning process did not exist, it would not be possible to assume any increases in transportation capacity.

A formal planning process was established by Federal mandate for all metropolitan areas in the 1960s so that each metropolitan planning organization would prepare a long-range regional transportation plan and a supporting five- or 10-year capital budget. In the nine-county Bay Region, the Metropolitan Transportation Commission was established in 1972 to prepare the regional planning and programming documents required by the Federal Department of Transportation to approve Federal funding for transportation projects. MTC was also given additional powers by the State Legislature to approve for Federal or State funding only those transportation projects found by the Commission to be in conformance with MTC's Regional Transportation Plan (RTP). It is for this reason that the list of projects considered to provide "reasonably assured capacity" are all described and included in the latest version (1987) of MTC's RTP, as capital projects not included in the RTP cannot receive State or Federal funds for preliminary engineering, design, right-of-way acquisition, construction or purchase of equipment.

The capital projects included in MTC's RTP are defined in a variety of ways. Some are identified through planning studies initiated by MTC in cooperation with counties and cities; and others are identified through planning studies initiated at the local level, including transit agencies, or planning or public works departments.

Although the MTC RTP can be amended every year, a formal amendment process usually occurs every two years. It is at that time, that the recommendations of recently completed studies, or in some cases, requests by public officials and citizens to change the RTP, are considered by the Commission.

The RTP contains descriptions of the major transportation facilities and services that MTC would endorse for development through the use of local, state and federal funding, but the RTP does not describe when those projects should be implemented. The distinction between priorities for longer-term and shorter-term implementation occurs every year when MTC adopts the five-year Regional Transportation Improvement Program (RTIP). The RTIP identifies all of the capital projects that MTC is recommending to the California Transportation Commission (CTC) and the Federal Department of Transportation for allocations of State and Federal funding. The final and most important determination of regional priority setting occurs when MTC approves the upcoming five-year RTIP which includes the listing of projects to be implemented in the first year of the next five-year programming cycle. The RTIP is then submitted to the CTC for that policy-making body to determine statewide funding priorities and allocate discretionary funds among projects submitted by different regional transportation planning agencies.

The projects to be included in the RTIP are nominated by agencies having the specific responsibility for the construction, operation or maintenance of a particular type of transportation facility or service. Caltrans, for example, would submit projects for funding on the State Highway System (U.S. 101, I-280, I-80). County or City Public Works Departments would submit projects for funding on major local roads (Third Street, King Street). Each transit operator would nominate projects such as the purchase of buses and other equipment; or the construction of maintenance facilities, transit stations, or park-and-ride lots.

A formal planning process has been established by the Federal Urban Mass Transportation Administration requiring transit operators receiving federal capital or operating assistance to annually prepare a five-year Short Range Transit Plan (SRTP). The SRTP describes the existing ridership and revenue situation, presents an evaluation of ways to eliminate or reduce service deficiencies, and concludes with a presentation of fiscally-balanced service plan and capital facilities plan. (Fiscally-balanced means that the transit operator has projected revenues from fares, advertising, locally earmarked taxes, and State and Federal funding sources to develop a service plan and a capital plan to support the service plan) that can be implemented by the operator. Just as the MTC RTP describes what should happen and the RTIP determines when it could happen, the SRTP's describe what general levels of service should be provided five years out but the detailed route-level service decisions are made on an annual basis.

In summary, while a formal process has been established to determine which projects will be built or operated in the region, the determination of priorities is an on-going political process with annual milestones. Capital projects that are included in the first year of the next five-year RTIP are considered to have the highest priority for implementation, for if those projects do not receive all the State and Federal funding that is being sought for them, then the political understanding is that those same projects will be resubmitted in the next RTIP as projects to be funded in the first year.

Perhaps the major uncertainty affecting the implementation of a specific project, once that project has received political endorsement at the local and MTC levels, is that changes in the availability of funding will modify the project's implementation schedule. Almost all transportation projects, especially those providing regional service, are funded using a variety of local, state and federal revenue sources. Highway and street projects are funded using gas taxes collected at the state and federal levels, municipal or county general funds (derived from a variety of sources), and if appropriate earmarked sales taxes and bridge tolls. Transit projects are funded using passenger fares, advertising, special fees (such as the Transit Impact Development Fee in San Francisco), State Transit Development Act (TDA) funds, State Transportation Planning & Development (TP&D) funds. Article XIX (California Constitution) funds for guideways, UMTA discretionary and block grants, and transfer of Federal Aid Interstate capital grants for cities that have chosen not to build an approved interstate highway. While some funding sources are earmarked for highways or transit, some funding can be used either for transit or highway projects. Federal Aid Urban (FAU) funds, for example, are apportioned to counties for street or transit purposes. Local or regional policy bodies may also decide to use sales taxes (if approved by the electorate) for transit and/or highway purposes.

Based on the current status of planning and programming decisions, the list of projects included in the definition of "reasonably assured" capacity for the year 2000 can be subdivided further into the following categories:

- The first category includes projects that will be built within five years or fewer because funding has already been allocated to them by MTC, the CTC and the Federal Department of Transportation. The following projects are in this category: increasing BART's passenger-carrying capacity by adding 150 "C" cars, building a turnback facility at Daly City and a yard at Colma, installing an automated wayside train control system, and providing several thousand additional parking spaces and enhancing feeder bus services to BART stations; widening U.S. 101 from San Carlos south to the Santa Clara County line; building the MUNI Metro Turnback and extending MUNI Metro to the CalTrain terminal; and deploying additional MUNI light rail vehicles and extending streetcar service ("F" and "J" lines).

- The second category includes transit projects that would be consistent with current short range transit plans or highway included in the RTIP that have not been allocated full funding, as follows: providing HOV lanes on U.S. 101 between the Richardson Bay Bridge and Novato, widening I-80 and adding HOV lanes, and buildings reversible facility for HOV lanes at the I-580/I-880/I-80 interchange. Funding has already been allocated for portions of these projects, as for example, extending HOV lanes on U.S. 101 in Marin County. As the regional programming consensus is based on continuing to fund projects for which at least partial construction is underway and as roadway and HOV projects are designed to be built and operate in segments, these projects have a very high probability of being completely funded through upcoming RTIP's.

- The third category includes projects that the transit operators have defined in a 10-year (or longer) capital improvement program, as follows: increasing MUNI's peak-period passenger-carrying capacity across each screenline within San Francisco, and providing additional SamTans service into San Francisco. While UMTA requires transit operators to evaluate their capital needs only five years out when updating their SRTP's annually, some transit operators have used local and regional growth projections for their service areas to define longer-term capital requirements. MUNI has prepared a forecast of capacity required by corridor to serve travel demand anticipated due to employment and population levels in San Francisco in about the year 2002. While funding for these capacity increases is not budgeted, this official planning conclusion will serve as MUNI's justification to seek the funding required to serve anticipated demand for MUNI service. SamTrans has developed a capital plan for the year 2000, which is based on the assumption that CalTrain will not have been extended into downtown San Francisco. SamTrans has the capital and operating funds from its earmarked local sales tax fund to implement this long range growth concept.

- The last category includes projects that the transit operators have indicated they would implement when travel demand would warrant: increasing AC Transit's peak-period Transbay passenger-carrying capacity and increasing Golden Gate Transit's transbay service. The modest AC Transit increases would require additional Bridge toll funding from MTC, and Golden Gate Transit would seek increases in Golden Gate Bridge tolls to implement the additional services. Both transit agencies have increased and decreased their Transbay services in reaction to changes in employment in Downtown San Francisco, and fluctuation in gasoline prices and availability. Both operators indicated that they would seek the funding required in the future to serve anticipated Transbay travel demand.

There are other transportation projects that have been proposed at one time or another that are not considered reasonably assured. Those projects are not included in the MTC RTP or have political opposition. For example, regional consensus did not exist at the time this EIR was begun on the CalTrain extension into Downtown San Francisco.

Regional Transportation Facilities and Services -- 2000

Highways. By the year 2000, Route 101 is assumed to be widened to eight lanes through San Mateo, Santa Clara and Marin Counties. In San Mateo County, only the segment south of San Carlos remains to be widened, and Caltrans has identified this project as being of high priority for construction./6/ Santa Clara County has advanced local funds to the State for widening Route 101 from the San Mateo County line to Bernal Road in south San Jose. In Marin County, Route 101 is programmed to be widened to eight lanes from North.

San Pedro Road in San Rafael to Atherton Avenue in Novato. Widening of Route 101 through central San Rafael is also a high-priority project, assumed to be funded and constructed by the year 2000./7/ Widening of Highway 101 in Marin County would provide continuous High-Occupancy-Vehicle (HOV) lanes from Larkspur to Novato, and the seventh and eighth lanes of a widened Highway 101 in Santa Clara are also likely to be devoted to HOV.

I-280 in San Francisco is assumed to terminate at Sixth Street, with the Fourth Street off-ramp removed. Implementation of this project is to be financed with funds transferred from the I-280 / Embarcadero Freeway connection that was withdrawn from the Federal Interstate System.

HOV lanes are assumed to be provided on I-80 eastbound from the Bay Bridge area to just north of Ashby Avenue (Berkeley), with westbound HOV lanes added from Willow Avenue (Rodeo) to McBryde Avenue (Richmond). A short stretch of westbound HOV lanes will be built on I-580 at the I-80 / I-580 interchange./9/

Reconstruction of the I-880 / I-580 / I-80 distribution structure at the eastern (Toll Plaza) terminal of the Bay Bridge is not anticipated, but a reversible facility for HOV's is assumed to exist from just west of the distribution structure east to the Route 24 / I-580 interchange./10/ I-880 (Nimitz Freeway) is to be upgraded through Alameda County as a result of its designation as an Interstate facility and the use by Alameda County of local sales tax revenues to pay for widenings and interchange improvements. (The widening of I-880 is planned for the southern portion, where between Union City and Santa Clara County the freeway is to be at least 8 lanes wide.)

Transit. The analysis of year 2000 travel conditions at screenlines relied on comparing the forecasts of year 2000 transit travel demand against the "reasonably assured" capacities identified by each transit operator serving San Francisco. While transit operators typically rely on five-year planning horizons to describe the facilities and services that they are committed to, a longer-range projection of capacity was requested of each transit operator.

Each transit operator considered operational or technological constraints, current financial and financing capabilities, and explicit or implicit system development policies to define the following projections of future service capacity/11/:

- MUNI's service capacity is projected to increase because of the MUNI Metro Turnback project, extensions of MUNI Metro, and the deployment of articulated coaches increasingly to replace standard coaches on high- ridership routes. The number of seats provided by MUNI would increase because of capital projects included in MUNI's 1988-92 Capital Improvement Program. The number of

person-carrying spaces provided by MUNI would increase more rapidly than the number of seats, because 1) articulated buses would replace standard buses on some routes, and 2) the number of light rail vehicles (LRV) and refurbished streetcars, all of which also contain more spaces per vehicle than buses, would increase more rapidly than the number of buses.

- BART's service capacity is projected to increase because headways of trains serving the East Bay lines would decrease from 3.75 minutes to 2.25 minutes during the peak hour and from 5.0 to 3.0 minutes during the second peak-hour. Those increases in Transbay capacity would occur because of deployment of 150 "C" cars currently on order; the addition of 50 more BART cars; construction of the Daly City Turnback/Yard; and technological improvements in automatic train control, wayside train control and upgraded electrification included in BART's 5-Year Plan. BART could increase Westbay capacity coincident with increasing Transbay capacity, if warranted by travel projections.

- Golden Gate Transit would attempt to secure the financial resources necessary to provide the expanded level of bus and ferry service required to serve increased travel demand between the North Bay counties and San Francisco.

- AC Transit is projecting very small increases in Transbay service, not because of low demand projections, but because of system development and financial allocation policies established by MTC affecting BART and AC Transit.

- Caltrans, the agency currently in charge of CalTrain, envisions no increase in peak-period service until the downtown extension is constructed. As the extension has not secured funding, Caltrans has assumed the provision of the same number of peak-period trains as in 1985.

- SamTrans is projecting to nearly double the number of bus trips scheduled into downtown San Francisco, because of historical ridership growth trends and the District's assumption that CalTrain will not be extended to downtown by the year 2000. Although SamTrans' latest Short Range Transit Plan does not specify the acquisition of all the buses required for this large increase in capacity, the availability of Federal capital funding for new buses is seen as the only significant factor constraining this level of expansion.

FUTURE TRAVEL FORECASTS

2000 Screenline Model

To develop future travel forecasts, two elements of the screenline model were modified. First, the trip base was changed to reflect the number of future-year employees and employed residents within Downtown & Vicinity. Second, the geographic distributions of places-of-residence for employees and places-of-work for employed residents were modified to reflect projected changes in the growth of housing supply or employment centers outside Downtown & Vicinity. Once those two changes had been made, the model was used to generate the initial year 2000 travel forecasts.

The initial forecasts of year 2000 travel were derived from "unconstrained" assignments that did not consider capacity limitations at the screenline locations. Therefore, in heavily traveled corridors, such as the bridges, "unconstrained" travel demand would appear to exceed capacities available during the peak period. Those forecasts of "unconstrained" travel identified the magnitude of diversion to transit and ridesharing necessary to accommodate year 2000 travel demand. Reassignments of travel by mode were then prepared to be used in the impact analysis.

Both RHA and MTC provided information used to guide the growth in the trip base and changes in geographic distributions. RHA's forecasts of employees and employed residents in San Francisco were used to develop travel demand forecasts for Downtown & Vicinity and to modify MTC's travel forecasts for the rest of San Francisco. MTC's travel forecasts were used directly to forecast year 2000 travel to or from the region outside San Francisco./12/ For the Project Area and Downtown & Vicinity, RHA provided projections of employees and employed residents at the traffic-analysis-zone level, so that detailed forecasts of travel patterns within Downtown & Vicinity could be prepared.

Modal forecasts of travel to and from Downtown & Vicinity were based on 1985 data and relationships developed between employment in Downtown & Vicinity and outbound travel by mode at each screenline, compared to counts of vehicles and transit riders at screenlines. Adjustments to the (initial) "unconstrained" modal splits were made for the year 2000 travel forecasts to account for the anticipated capacity and LOS provided by the different modes at each corridor.

2000 Impact Analysis

Once the distributions were defined for inbound and outbound trips, the model was used to estimate year 2000 "constrained" demand at the screenlines. Estimation of "constrained" demand required three steps. Changes were made in screenline capacities to reflect changes between 1985 and 2000 in transit LOS. A review of year 2000 "unconstrained" travel demand vs. capacity at each screenline indicated where "unconstrained" demand would be below capacity, at capacity or above capacity. At the locations where "unconstrained" demand would be above capacity, potential actions were defined to create the forecasts used in the impact analysis.

As it was assumed that little or no additional highway capacity could be expected in the future, the list of potential actions regarding those locations where "unconstrained" demand was forecast to exceed capacity was limited to the following:

- reduce the projected employment and residential estimates,
- reduce peak-period and peak-hour trip rates to fit within the available capacities (e.g., spread the peak period out),
- increase automobile occupancy rates, and/or
- divert more persons to transit (increase transit mode split).

Rather than recycle the forecasts of future employment and population, the methodology maintained the level of development projected for Downtown & Vicinity by RHA and for the rest of the region by RHA and ABAG, to represent the most conservative condition (i.e., the largest amount of travel). Therefore, for the purpose of this EIR the first action was eliminated from consideration. Further spreading of the peak period was not considered as an input to, but as an output of the analysis, as it was assumed that if transit service and high-occupancy-vehicle (HOV) facilities were available, persons would continue to want to travel at the same times as today. Therefore, the remaining two actions (increased vehicle-occupancy rates and diversion to transit) were considered as the two primary ways (variables) to reduce excess vehicle demands.

Since the potential actions are related (an increase in one reduces the need for the other), it was necessary to monitor the impact of changing either variable. The first step of the process was to define some reasonable level of increase in auto occupancy that would then determine the needed level of diversion to transit. On the basis of the potential change resulting from improvements such as HOV lanes, a likely increase in auto occupancies was

estimated to be 7% to 15% over the existing levels. The magnitude varies by screenline, depending on the existing occupancy rate and potentially available HOV facilities.

Once the future auto occupancies were defined, it was possible to estimate the number of persons who would be projected to be diverted to transit. That number of person trips was then compared to the number of transit vehicles to be operated, to ensure that policy load factors for each transit operator would not be violated. Additional shifts from one transit operator to another were forecast, as from BART to AC Transit, when the load factor objective would not be satisfied.

Intersection Model. Once changes from 1985 auto occupancy and transit usage had been established for each screenline, it was then possible to use the intersection model to estimate year 2000 intersection turning movement volumes. The auto trips generated by each Alternative were used in the auto trip table, along with revised numbers for regional trips traveling on the Mission Bay street network to or from Downtown & Vicinity. The intersection analysis is based on the same mode split for Mission Bay as derived across each screenline for Downtown & Vicinity. Regional trips were projected at the zone level, by use of ratios developed from MTC's travel forecasts. In order to estimate travel within Downtown & Vicinity at the zone level, it was necessary to replace the 1985 numbers of employees and employed residents within each zone with the year 2000 forecasts.

The proposed EIR Alternatives introduce new roadway patterns, including changes in the freeway ramp connections. Those proposed changes would have a direct impact on future auto travel within Downtown & Vicinity. As some changes would apply to all Alternatives (new and removed freeway connections), and as there were significant numbers of differences in the surface streets, travel paths for each Alternative were reviewed. Once those changes had been incorporated into the assignment model, it was possible to generate turning movement estimates for the critical intersections.

2020 Impact Analysis

Travel forecasts for the year 2020 build upon the final travel forecasts for the year 2000. For the year 2000, the modal split and auto occupancy factors developed during the course of the 1985 calibration had been used initially to create forecasts of unconstrained demand. The forecasts of "unconstrained" demand were then used to modify the initial mode split and auto occupancy factors, to create forecasts of travel by mode across screenlines that reflect the projected shift toward transit and carpooling by persons who would be traveling from Downtown & Vicinity.

The shifts in auto occupancy rates and transit usage projected for Downtown & Vicinity travelers for the year 2000 for travelers from Downtown & Vicinity reflect historical data and the anticipated development of "reasonably assured" transit and HOV facilities. The auto occupancy and modal split factors (that account for vehicle capacity constraints) finally calculated to represent conditions for the year 2000 were then used (unchanged) to create the year 2020 travel forecasts, as the 2020 analysis is based on using forecasts of demand to identify the magnitude of increases in capacity required between 2000 and 2020.

Forecasts of population and employment prepared by RHA were used to create the separate forecasts of travel to or from 1) Downtown & Vicinity, 2) the rest of San Francisco, and 3) the rest of the region. Outside Downtown & Vicinity, the year 2020 travel forecasts are based on the application of travel factors on ratios of 2020 to 2000

population or employment. For Downtown & Vicinity, projections of outbound and inbound travel are based on the application of the screenline model produced by Barton-Aschman Associates, Inc. for this EIR analysis. The 2020 projections of travel demand are not constrained by capacity, as the purpose of the analysis was to define the magnitude of additional capacity required beyond that identified as reasonably assured for 2000.

- VARIATION IN TRAVEL FORECASTS

- Travel demand forecasts analyzed in the Mission Bay EIR incorporate variations inherent in travel counts and forecasts. The following paragraphs explain the effects that different types of variations could particularly have on forecasts of future local traffic and transit travel, and their associated levels of service analyzed in the EIR.

- The travel forecasts presented in this EIR should not be viewed as expressions of exact numbers, but rather as predictions of the most likely values expected to exist under conditions projected to affect future travel. There are two major reasons why the travel forecasts should be viewed as representing a range of numbers at least five percent and as much as 15 percent greater or smaller than the discrete values presented in the EIR for traffic volumes at local intersections or transit riders at screenlines.

- The first reason is that there is that much variation inherent in the current counts from which the future travel forecasts are derived. Reasons for such variation include changes in daily travel patterns, and interruptions or degradations in roadway or transit services due to accidents or mechanical failures. Daily variations in trip departure times and routes caused by each traveler's decision not to deviate from past practices, or (conversely) to make changes due to anticipated problems or new opportunities, also affect travel demand.

- The second reason to expect variations in the forecasts of future travel is that each of the assumptions applied to create the travel forecasts -- about geographic directions of travel, modes of travel used, and the percentage of travel to occur during peak hours -- is associated with a certain variation. Thus, for example, the percentages of persons employed in the Downtown & Vicinity traveling to the East Bay could vary from the percentage stipulated in the EIR, as could the percentages of persons driving alone or riding BART, or as could the percentages of persons traveling away from the Downtown & Vicinity between 4:30 and 5:30 PM. The range of variation depends directly on what is being forecast.

- The smallest variations would be associated with the percentages of workers traveling away from the Downtown & Vicinity between 4:30 and 5:30 PM, because extensive data have established strong predictive trends for this factor. A very small range in variation is associated with peak-hour and peak-period forecasts by mode at the screenlines, because of the very high probability that future travel demand to or from the Downtown & Vicinity would be defined by transportation supply. For example, this situation applies to travel across congested highway corridors in San Francisco (where more auto trips cannot be readily accommodated during the peak period). There is high probability (and thus little variability in the forecasts) that some of the highways would operate at or above capacity conditions during the p.m. peak period in the future. Travel corridors such as the Bay Bridge have very limited future capacity (supply) relative to future peak-hour (and peak-period) travel demand. Thus the forecasts that the Bay Bridge would be operating at full capacity beyond the two-hour peak period have a very small range in variation.

- The middle range of variation applies to forecasts for a group of (non-freeway-access) intersections, or a group of MUNI lines serving common geographic areas. In

- San Francisco, where there often are different available route options on streets or MUNI to reach a desired destination, the collective travel forecasts of the geographic group are less variable than for an individual forecast within the group. Thus, for example, there is less variability in forecasting the number of trips on all MUNI lines from the Downtown & Vicinity to Mission Bay than there is for forecasting how many of those trips would occur on the 30-STOCKTON line.

- The largest ranges in variation are associated with forecasts for localized travel for individual MUNI lines or intersections within Mission Bay serving only Mission Bay traffic. They incorporate not only the types of variations described above for screenline forecasts, but also greater variations reflected in a wider choice of transit or vehicle routes that could be selected by travelers to reach their destinations. In other words, there is greater variability in the forecasts for localized travel than for travel crossing the regional screenlines because there are more transit and street route options available to travelers for such local travel than for travelers crossing the screenlines. Travel within systems with a large number of route options is more difficult to forecast than for systems with fewer or no alternate routes, thus making forecasts more variable.

- Traffic counts collected at the I-280 off-ramp located at Fourth and Berry Streets provide a vivid example of the variation inherent in traffic counts. In November 1988, Caltrans counted vehicles at that location in order to compile information for the environmental assessment that agency is preparing on the reconstruction of I-280's terminal ramps in Mission Bay./12a/ The 1988 counts indicated that, between 4:30 and 5:30 PM, approximately 1,660 vehicles were using the I-280 off-ramp at Fourth and Berry Streets compared to the approximately 1,250 vehicles counted in 1985 for the Mission Bay EIR./12b/ Analysis of historical counts revealed that no discernible relationship existed between the counts at this location and regional growth in jobs or housing. This also was the case for other counts taken for the I-280 ramp in the 1980's. In 1980, there was a peak-hour count of 1,700 vehicles, higher than all other counts taken during the 1980's; in 1983 there was a count of 1,250 vehicles.

- A number of possible explanations could be offered as to why the counts taken during the PM peak hour at the I-280 off-ramp during the 1980s do not increase steadily, as did the growth in jobs in San Mateo County or the growth in housing in the Downtown & Vicinity or even people's propensity to drive. It is possible that the variations in overall daily travel patterns described above could cause fluctuations in peak-hour traffic volumes on the ramp of from 50 to 200 vehicles from one day to another. Those fluctuations could be exacerbated by an accident or other event affecting the level of service perceived by motorists traveling on U.S. 101 or I-280. Thus, for example, relatively high volumes measured at one off-ramp could correspond with relatively lower volumes at other off-ramps. Greater understanding of such fluctuations requires more than a traffic count at a single location; complete travel count information for the years in question is required to compare total travel in the U.S. 101 and I-280 corridors so as to determine what the fluctuations in the I-280 ramp counts could be attributed to.

- In any case, the travel forecasts presented in the Mission Bay EIR are all based on a travel forecasting model that was developed using 1985 data for population and employment, and travel to or from Downtown & Vicinity, by time of day, mode and direction. The predictive powers of the model are derived from the comprehensive review of transportation demand and supply relationships that existed in 1985. Therefore, all forecasts presented in the EIR are internally consistent with each other, since all baseline information used in the analysis is for 1985.

- In summary, variations inherent in existing travel patterns and counts can create variations in the forecasts of future travel patterns and volumes. The smallest variations, either existing or future, would be associated with travel by mode across screenlines. The largest variations would be associated with travel demand forecasts for specific intersections or transit routes.

PARKING ANALYSIS

Parking Supply: All Alternatives, Years 2000 and 2020

The parking supply rates assumed were the same for both year 2000 and year 2020 forecasts. Since code requirements for the Project Area have not been set, rates were postulated for planning purposes in Alternatives A and B as shown in Table XIV.E.7 below./13/ For Alternative N, rates were based on current code requirements.

TABLE XIV.E.7: PARKING SUPPLY RATIOS, 2000 AND BUILD-OUT/2020

Land Use	Parking Supply/a/ A & B	Ratios/b/ N	Units
Office/c/	1	2	space/1,000 s.f.
S/LI/RD/c/	1	1	space/1,000 s.f.
M-2, Industrial,new	1	0.67	space/1,000 s.f.
Port-related, M-2	0.67	0.67	space/1,000 s.f.
Retail	1	1	spaces/1,000 s.f.
Hotel	0.4	0.4	space/room
Community Facilities	1	0.67	space/1,000 s.f.
Train Station / Station	0	0	
Housing	1	1	space/d.u.
Houseboats	1	1	space/d.u.
Pleasure Craft	1	1	space/boat
M-2 Industrial, remaining	0.67	0.67	space/1,000 s.f.

/a/ Parking Supply rates are based on Roger Owen Boyer & Associates, "Zoning characterization of the Alternatives", June 25, 1987, for Alternatives A and B.
/b/ For Alternative N, the supply rates are set by City of San Francisco Zoning Code parking requirements. All floor areas are gross building floor areas.

SOURCE: Barton-Aschman Associates, Inc.

Parking Demand

Daily peak parking demand rates generated by non-residential land uses, expressed as total parking spaces per unit of floor area, were estimated as a function of forecast employment.

To establish the probable daily demand for off-street parking, parking demand rates were developed for each major land use category. For non-residential uses, parking demand rates were developed on the basis of the each land use's projected employee density, absentee rate, employee mode split, visitor travel and auto occupancy. Employment and floor area for each land use in the three Alternatives is shown in V. The EIR Alternatives and Approval Process, Tables V.2 and V.3, pp. V.9 and V.20. A parking demand rate of 0.04 spaces per daily boarding passenger was estimated for CalTrain passengers, based on CalTrain's October, 1987 interview survey of boarding passengers at the Fourth and Townsend terminal.

For residential uses, a single rate of 1.0 spaces per dwelling unit was used, based on both a review of the 1980 Census data on vehicle ownership per dwelling unit (0.89 City- wide, and 0.90 for the Marina/Cow Hollow tracts) and confirmed by survey data from comparable housing projects in the City./14/

For non-residential demand, the employment rates were converted to parking demand rates for each type of use using the following formula:

$$D = \frac{(E * AR * CA) + V}{O}$$

Where:

D = Daily peak parking demand generated by the land use, including employee, visitor, customer, and service trips.

E = Employees per thousand gross sq. feet of floor area. (Varies by type of use and year)

AR = Absentee rate (0.889 for all scenarios, uses and years).

CA = Combined auto mode share of employee work trips, equal to the weighted sum of 0.30 for those traveling in the peak commute period and 0.75 for those traveling at other times of the day. The share of employees who commute during the peak period was estimated based on the 1981 South of Market employee survey, at 62% of total employees./15/

O = Auto occupancy of employee work trips. Like the mode split, this is a combined factor, consisting of the weighted sum of 1.25 auto occupancy for employees who travel during the peak period, and 1.10 for employees who travel at other times of the day for all uses and both years.

V = Visitors per thousand gross sq. feet of floor area. This is a calibrated constant for each land use. The value was determined by setting the other parameters equal to current conditions for typical development and solving for D equal to the average ITE parking demand rate for this use./16/ This visitor parking rate varies from 0.09 to 0.59 spaces per thousand square feet, depending on type of use. This value was held constant for 2000 and 2020.

Auto mode split and occupancy were set to the same rates for the year 2000 and 2020 travel demand impact analysis, with the resulting final peak parking demand rates shown in Table XIV.E.8. These parking demand rates are intended to estimate parking spaces per unit of land use needed for Project Area land uses, assuming that 70% of peak-period commute trips are on transit.

The mitigation measures proposed for parking include revisions to the postulated parking supply requirements for Alternatives A and B. The amounts of these revised rates were derived by first estimating the parking requirement needed to meet forecast CalTrain station and Hotel demand and then calculating the parking requirement for Office, S/LI/RD and M-2 uses that would eliminate the remaining deficit. The revised parking requirements presented in the Mitigation Section, if applied to development in the Project Area, would eliminate the parking deficiency and hence the potential for spillover parking demand generated by Project Area non-residential uses to Project Area residential streets, and to streets outside the Project Area. It should be noted that the actual zoning ordinance should be tailored to specific land use parking requirements.

TABLE XIV.E.8: PARKING DEMAND RATIOS, YEARS 2000 AND 2020

		Parking Demand Ratio Per Unit/a/	
	Units	2000	2020
Office	GKSF	1.35	1.35
S/LI/RD	GKSF	0.91	0.91
M-2 Industrial	GKSF	0.92	0.92
M-2 w/o 3rd., remaining	GKSF	0.42	0.42
M-2 e/o 3rd., remaining	GKSF	0.82	0.82
M-2 Port related	GKSF	0.63	0.63
Retail	GKSF	1.57	1.52
Hotel	ROOM	0.84	0.84
Community Facilities	GKSF	1.0	1.0
Train Station/b/	unit	0.04	0.04
Housing (d.u.)/c/	unit	1.0	1.0
Houseboat/pleasure craft	unit	1.0	1.0

/a/ Resulting from the parking demand formula as explained in the text, except for residential and train station rates.
/b/ CalTrain station rate based on a 10/87 survey conducted by CalTrain of passengers boarding at Fourth and Townsend Streets. The surveys found that 4% of daily boarding passengers drove alone to the station. PM peak-period boardings were 70% of total boardings. Assuming this in the future ratio to total daily boarding remains constant, and the same proportion drive alone, the parking demand rate shown can be applied to forecasts of daily CalTrain boarding volumes, expanded from p.m. peak outbound passenger forecasts, for each alternative in year 2000 and 2020.
/c/ Based on field surveys and census data.

SOURCE: Barton-Aschman Associates, Inc.

NOTES - Transportation

/1/ Outbound trips would be heading away from Downtown & Vicinity during p.m. peak hours, and inbound trips would be heading toward Downtown & Vicinity during p.m. peak hours.

/2/ The five areas of San Francisco account for trips that would be made to or from within Downtown & Vicinity or that would cross the four internal City screenlines -- to Northeast, Northwest, Southwest and Southeast San Francisco. The three regional screenlines account for trips that would be made to or from the North Bay, South Bay or West Bay counties of the region.

/3/ As MUNI's structures of routes serving Downtown & Vicinity creates an overlap for some routes between these screenlines, some trips on MUNI traveling to the northeast area of San Francisco are registered at the northwest screenline and vice versa.

/4/ An evaluation of the methodologies included in the 1965 and 1985 Highway Capacity Manuals and the Circular 212 methodology was conducted and presented to the Department of City Planning in a March 18, 1986 memorandum from Barton-Aschman Associates, Inc.

/5/ Calculations by Barton-Aschman Associates, Inc., based on data supplied by David Conci, Superintendent of Bridges and Tunnels, San Francisco Department of Public Works, May 1986.

/6/ Metropolitan Transportation Commission Regional Transportation Improvement Program 1986-87, April 23, 1986, p. A-6.

• /7/ MTC, RTIP, op. cit., pp. A-3 and A-4.

• /8/ MTC, RTIP, op. cit., p. C-53.

/9/ MTC, Regional Transportation Plan, November 1986, p. 39.

• /10/ MTC, RTP, op. cit., p. 37.

/11/ The letters submitted by the transit operators are on file at the San Francisco Department of City Planning, 450 McAllister Street, San Francisco.

• /12/ MTC maintains a regional travel model that that agency has used to create forecasts of travel throughout the region for the years 2000 and 2005. MTC's distribution of travel is generated on the basis of ABAG's housing and employment forecasts and a methodology incorporating existing and future travel times between zones. That methodology considers travel time between population zones and employment zones, as well as the number of persons or employees in the zones to develop changes between current and future trip interchanges between zones. Those employment changes would have a direct impact on the distribution of San Francisco residents working outside San Francisco, as well as of residents of other counties traveling to Downtown & Vicinity for work and related trip purposes.

• /12a/ As discussed on p. V.11 of the Mission Bay EIR, the existing I-280 off-ramp at Fourth and Berry Streets will be replaced with a new set of on- and off-ramps that would touch down to grade east of Sixth Street to serve the new King Boulevard.

• /12b/ The Fourth and Berry off-ramp counts for 1985 are part of the background information for the Mission Bay EIR transportation analysis available for public review in the Office of Environmental Review at the Department of City Planning, 450 McAllister Street, San Francisco, California 94102. The 1988 Caltrans counts, and associated level of service calculations for Fourth and Berry Streets and other nearby intersections, also have been added to the background information available for public review.

/13/ Parking supply rates for Alternatives A and B are based on a memo by Roger Owen Boyer & Associates, "Zoning characterization of the Alternatives", June 25, 1987.

/14/ See for example, Environmental Science Associates, Inc. and Wilbur Smith & Associates, Parking Demand Study: Park Hill Residential Project, 12/22/82, where parking demand was found to be 1.00 spaces per dwelling unit or less.

/15/ Recht Hausrath Associates, 1983 survey of South of Market Area employee work trip characteristics, unpublished.

/16/ Institute of Traffic Engineers, Parking Generation, Second Edition, 1987.

APPENDIX F. AIR QUALITY

TABLE XIV.F.1: COMPARISON OF FEDERAL AND STATE AIR QUALITY STANDARDS, 1985

Pollutant	Averaging Time	Federal Standards Primary	Federal Standards Secondary	State Standard
Ozone (O_3)	1-hour	0.12 ppm	Same	0.10 ppm
Carbon Monoxide (CO)	1-hour	35 ppm	Same	20 ppm
	8-hour	9 ppm	Same	9 ppm
Nitrogen Dioxide (NO_2)	1-hour	-	-	0.25 ppm
	Annual	0.05 ppm	Same	-
Sulfur Dioxide (SO_2)	1-hour	-	-	0.5 ppm
	3-hour	-	0.5 ppm	-
	24-hour	0.14 ppm	-	0.25 ppm
	Annual	0.03 ppm	-	-
Total Suspended Particulate (TSP)	24-hour	260 ug/m^3	150 ug/m^3	100 ug/m^3
	Annual/a/	75 ug/m^3	60 ug/m^3	60 ug/m^3
Inhalable (Fine) Particulate (PM_{10})/b/	Annual	50 ug/m^3	Same	30 ug/m^3
	24-hour	150 ug/m^3	Same	50 ug/m^3
Lead	30-day	-	-	1.5 ug/m^3
	Calendar quarter	1.5 ug/m^3	Same	-

/a/ Geometric Mean.

/b/ State standards for particulate matter changed in 1983 and federal standards changed in 1987 to concentrate on fine particulate matter, which has been demonstrated to have health implications when inhaled. As actual monitoring for this fine particulate matter (or PM_{10}) did not begin in San Francisco until April 1986, both the previous TSP standards and the present PM_{10} standards are included. Although both the previous and present particulate standards are measured in micrograms per cubic meter (ug/m^3), under the PM_{10} standard only those particulates 10 microns or less in diameter are measured. While a complete analysis of PM_{10} measurements compared to the standards has not yet been published, it appears that the PM_{10} levels in San Francisco are below federal standards but may approach state 24-hour standards.

SOURCE: Bay Area Air Quality Management District, Air Quality Handbook 1985-1986; and Environmental Science Associates, Inc.

TABLE XIV.F.2: SAN FRANCISCO AIR POLLUTANT SUMMARY, 1982-1986

Pollutant	Standard	1982	1983	1984	1985	1986
Ozone (O_3: Oxidant)						
Highest 1-hr average, ppm/a/	0.10/b/	0.08	0.13	0.10	0.09	0.07
Number of standard excesses		0	1	1	0	0
Carbon Monoxide (CO)						
Highest 1-hr average, ppm/c/	20.0/b/	12	7	11	10	9
Highest 8-hr average, ppm	9.0/d/	9.1	5.1	7.7	7.1	7.1
Number of standard excesses		1	0	0	0	0
Nitrogen Dioxide (NO_2)						
Highest 1-hr average, ppm/c/	0.25/b/	0.13	0.13	0.14	0.12	0.11
Sulfur Dioxide (SO_2)						
Highest 24-hr average, ppm/c/	0.05/b/	0.01	0.02	0.03	0.03	0.03
Total Suspended Particulate (TSP)						
Highest 24-hr average, ug/m^3/a/	100.0/b,e/	126	117	152	158	124
Number of standard excesses/f/		3	4	5	5	5
Annual Geometric Mean, ug/m^3	60.0/b,e/	57	55	60	62	52
Respirable Particulate (PM_{10})						
Highest 24-hr average, ug/m^3	50.0/b/	NA	NA	NA	NA	78
Number of standard excesses/e/		NA	NA	NA	NA	5
Annual Geometric Mean, ug/m^3	30.0/b/	NA	NA	NA	NA	26
Lead/f/						
Highest 30-day average,ug/m^3/c/	1.5/b/	0.67	0.38	0.67	0.27	0.23

NA - Not available.
/a/ ppm: parts per million; ug/m^3: micrograms per cubic meter
/b/ State standard, not to be equaled or exceeded except for carbon monoxide and particulate standards which are not to be exceeded. Underlined values indicate excesses of applicable standards.
/c/ No standard excesses were monitored over the past five years.
/d/ National standard, not to be exceeded more than once per year. Underlined values indicate excesses of applicable standards.
/e/ State and federal standards for particulate matter changed in 1983 and 1987, respectively, to concentrate on fine particulate matter under 10 microns in diameter (PM_{10}). The previous particulate standard applied to total suspended particulates (TSP), that is, those with a diameter of 30 microns or less. PM_{10} constitutes the respirable fraction of TSP which has been demonstrated to have health implications. According to the BAAQMD, TSP is about 50 to 60% PM_{10}, so the TSP standards are generally equivalent to the PM_{10} standards.
/f/ Measured every six days.

SOURCES: Bay Area Air Quality Management District, Contaminant Summaries, 1982-1985, California Air Resources Board, Air Quality Data Summary, 1986, Baseline Environmental Consulting, Inc. and Environmental Science Associates, Inc.

TABLE XIV.F.3: TRAFFIC ESTIMATES USED FOR PROJECT AREA VEHICLE EMISSIONS CALCULATIONS

Traffic	Existing	2000 Alt. A	2000 Alt. B	2000 Alt. N	2020 Alt. A	2020 Alt. B	2020 Alt. N
VMT/a/							
Total/b/	179,000	695,000	386,000	436,000	1,490,000	903,000	1,070,000
SF County/c/	76,900	305,000	172,000	187,000	650,000	409,000	452,000
ADT/a/	15,900	69,000	41,000	39,000	150,000	104,000	94,000

/a/ VMT = Vehicle Miles Traveled; ADT = Average Daily Trips
/b/ Total VMT refers to vehicle miles traveled within San Francisco County as well as other Bay Area counties.
/c/ San Francisco County VMT refers to the fraction of the total VMT within San Francisco County. VMT within San Francisco County reflects an eight-mile trip length (within SF County) for North Bay trips, a four-mile trip length for East Bay trips, and a five-mile trip length for South Bay trips.

SOURCE: Barton-Aschman Associates, Inc., and Environmental Science Associates, Inc.

TABLE XIV.F.4: INDUSTRIAL SOURCES OF EMISSIONS IN AND NEAR THE PROJECT AREA, 1985

Source	Pollutants/a/
Concrete Plants/b/	TSP
Shipyards/c,d/	HC, SO_2, NO_x, CO
Train Terminal/b/	CO, HC, SO_2, NO_x, TSP
Bus Yards/b/	CO, SO_2, NO_x, HC
Coffee Roasting Firm/c/	Odor

/a/ Robert Nishimura, Air Quality Engineer, BAAQMD, telephone conversation, September 9, 1986.
/b/ On-site.
/c/ Off-site.
/d/ In 1987, Todd Shipyard was closed.

SOURCE: Baseline Environmental Consulting and Environmental Science Associates, Inc.

MISSION BAY BOUNDARY

■ FORMER BAAQMD MONITORING STATION 23rd and Tennessee Sts.

▲ CURRENT BAAQMD MONITORING STATION Arkansas at 16th St.

CRITICAL INTERSECTIONS	
① Second and Bryant	⑤ Third and Berry
② Fifth and Bryant	⑥ Third and Fourth
③ Sixth and Brannan	⑦ Third and 16th
④ First and Harrison	⑧ Mariposa and Pennsylvania

Mission Bay

FIGURE XIV.F.1
LOCATIONS OF CRITICAL INTERSECTIONS AND BAAQMD MONITORING STATION IN PROJECT VICINITY

SOURCE: Environmental Science Associates, Inc.

INTERSECTION CARBON MONOXIDE ANALYSIS

A modified version of the Modified Linear Rollback (MLR), an air quality mathematical model which assumes that CO concentrations are proportional to emissions, was used to estimate CO concentrations at intersections. The MLR model was used to analyze CO air quality for the 1982 Plan./1/ (Notes appear at end of Appendix F.) MLR assumes that total CO concentrations at an intersection consist of a local component (from CO emitted by vehicles at the intersection); and a background or ambient component, (from vehicle emissions within a larger sub-regional area, such as a city). The local and background concentration components increase or decrease in direct relation to emissions from the intersection and the sub-region, respectively. The modified MLR model uses a method for estimating CO concentrations based on average speeds that is more simplified than the MLR model.

Baseline Intersection. MLR is calibrated to local conditions through "hot-spot" CO modeling at a local intersection selected on the basis of worst-case traffic conditions. CO concentrations are measured during worst-case meteorological conditions to obtain the peak CO concentrations within the local area (worst-case intersection during worst-case meteorological conditions). For the Mission Bay Project Area, the intersection of Sixth and Brannan Streets was selected as the worst-case intersection. The results of the hot-spot monitoring are shown in Table XIV.F.5 and are compared with CO levels recorded at the BAAQMD Potrero Hill Station during the same period. The Sixth/Brannan Streets intersection is the "baseline intersection" from which CO concentrations for the other selected intersections considered in the air quality analysis are derived.

Baseline Concentration. The baseline concentration is the maximum eight-hour CO level that occurred during worst-case meteorology in the base year (1985). The baseline concentration equals the sum of the "background component" and the "local component." The "background component" of the baseline concentration is taken to be 7.1 ppm (the 1985 eight-hour value measured in San Francisco during worst-case meteorological conditions for CO dispersion).

The hot-spot monitoring data were used to determine the local component and, thus, to indicate the range of possible values for the baseline concentration at the Sixth/Brannan Streets intersection during worst-case meteorology. The baseline CO concentration could be between 9.6 ppm and 15.6 ppm. The 9.6 ppm value is calculated by adding the background CO value of 7.1 ppm to the local CO contribution of 2.5 ppm (see Notes to Table XIV.F.5). BAAQMD has determined that the 9.6 ppm CO concentration value could be taken to be the baseline concentration if supported by further hot-spot monitoring in the project vicinity.

The 15.6 ppm CO value is calculated by multiplying the background CO value of 7.1 ppm by a factor of 2.2 (see Notes to Table XIV.F.5). The 15.6 ppm CO concentration value is too high and cannot be supported by historical air quality data from BAAQMD community monitoring or previous hot-spot studies in San Francisco./2/

Another possible baseline CO value of 13.4 ppm is from the Downtown Plan EIR./3/ The BAAQMD has indicated that this concentration value would be appropriate to assume as a baseline concentration for 1985./4/ The corresponding one-hour average value would be 19.1 ppm./5/ Since December 1985 hot-spot monitoring did not occur during worst-case meteorology, the baseline CO concentration value for the Sixth/Brannan Streets intersection was derived theoretically. The hot-spot monitoring data indicate that the concentration value of 13.4 ppm is within the range of possible values for baseline CO during worst-case meteorology.

TABLE XIV.F.5: CO CONCENTRATIONS, HOT-SPOT MONITORING AND BAAQMD POTRERO HILL MONITORING STATION, DECEMBER 1985

Date (December)	CO Concentrations, Eight-Hour Average (ppm)/a,b/ Sixth/Brannan Streets/c/	BAAQMD Potrero Hill/d/
13	3.6	1.4
14	3.1	1.8
15	5.0	1.5
16	4.2	3.5
17	6.5	3.5
18	6.6	2.8
19	5.3	3.3
20	6.4	3.4
21	5.0	2.0
22	3.9	1.8
23	5.0	1.8
24	4.1	ND
25	ND	3.1
26	ND	2.1
27	4.2	2.5
28	3.3	1.0
Mean Value	4.7	2.4

ND - No data.
ppm - parts per million.

/a/ Average difference between hot-spot measurements and monitoring station measurements was 2.5 ppm. Average ratio between the two measurements was 2.2.
/b/ Measurements correspond to the period 5:00 p.m. to 1:00 a.m.
/c/ Environmental Measurements, Inc., letter to ESA, December 31, 1985.
/d/ Richard Duker, Meteorologist, BAAQMD, memorandum, January 15, 1986.

SOURCE: Baseline Environmental Consulting, Environmental Measurements, Inc., and Environmental Science Associates, Inc.

Scaling Factor. The CO concentration for each of the remaining critical intersections is the sum of the baseline background concentration value of 7.1 ppm, and a local concentration component computed by scaling the baseline local concentration. If the 13.4 ppm value is used as the baseline concentration, then the local component is the difference between 13.4 ppm and 7.1 ppm, or 6.3 ppm (at the Sixth/Brannan Streets intersection).

The scaling factor reflects the relative difference in traffic volumes and congestion between Sixth and Brannan streets and the seven other selected intersections. It is the ratio of estimated vehicular emissions at an intersection to vehicular emissions at Sixth and Brannan. The ratio of peak-period traffic volumes to eight-hour volumes between 5:00 p.m. and 1:00 a.m. is estimated to be the same for all of the selected intersections./6/ Therefore, scaling factors were derived from peak-period traffic characteristics.

Emissions Rates. The vehicular emissions are calculated based on peak period traffic, 4:00 p.m. to 6:00 p.m. Traffic volumes and average speeds for each of the selected intersections have been estimated for the peak period, as shown in Table XIV.F.6./7/ Table XIV.F.7 shows corresponding traffic and emissions data for 2000 and 2020.

TABLE XIV.F.6: PROJECT TRAFFIC AND EMISSION FACTOR DATA, 1985

Intersection	Peak Period Traffic Volumes/a/	Average Speed (miles per hour)/a,b/	CO Emission (grams/mile)/c/
1. Second/Bryant Streets	2,543	10-15	62 /d/
2. Fifth/Bryant Streets	4,393	5-10	77
3. Sixth/Brannan Streets/d/	10,591	0-5	123
4. First/Harrison Streets	3,229	5-15	62
5. Third/Berry Streets	7,079	5-15	62
6. Third/Fourth Streets	5,261	15-20	45 /d/
7. Third/16th Streets	5,167	15-20	45 /d/
8. Mariposa Street/ Pennsylvania Avenue	1,862	10-15	62

/a/ Norman Steinman, Senior Associate, Barton-Aschman Associates, Inc., letter, July 30, 1986.
/b/ Includes time spent at intersections for signal delay.
/c/ BAAQMD emission factors derived from ARB emission factors, version EMFAC7D.
/d/ Baseline intersection.

SOURCE: Baseline Environmental Consulting, Inc.

NOTES - Air Quality

/1/ ABAG, BAAQMD, and MTC, 1982 Bay Area Air Quality Plan, 1982.

/2/ Thomas E. Perardi, Manager, Research and Planning Section, BAAQMD, telephone conversation, August 13, 1986.

/3/ San Francisco Department of City Planning, Downtown Plan Environmental Impact Report, EE.81.3, certified October 18, 1984.

/4/ The BAAQMD has determined that the 9.6 ppm CO value could be assumed as the baseline concentration if supported by further hot-spot monitoring in the project vicinity. The 15.6 ppm CO value is excessively high and cannot be supported by historical air quality data from BAAQMD community monitoring, or by previous hot-spot studies in San Francisco. Thomas E. Perardi, BAAQMD, telephone conversation, August 13, 1985.

TABLE XIV.F.7: PROJECT TRAFFIC AND EMISSION FACTOR DATA, 2000 AND 2020

Intersection	Peak Period Traffic Volume, 2000/a/			Peak Period Traffic Volume, 2020/a/			Average Speed (miles per hour)	CO Emission Factor (grams/mile)/b/
	Alternative A	Alternative B	Alternative N	Alternative A	Alternative B	Alternative N		
1. Second/Bryant Streets	3,200	3,200	3,200	3,500	3,500	3,500	10	31
2. Fifth/Bryant Streets	6,000	6,100	6,000	6,500	6,400	6,200	10	31
3. Sixth/Brannan Streets/c/	10,200	10,200	10,500	10,800	10,700	11,200	5	39
4. First/Harrison Streets	3,900	3,900	3,900	4,300	4,300	4,400	10	31
5. Third/Berry Streets	4,700	4,700	4,700	5,600	5,200	5,400	20	19
6. Third/Fourth Streets	5,500	5,100	5,600	6,100	6,000	6,000	20	19
7. Third/16th Streets	5,900	5,600	5,600	6,400	6,000	6,200	20	19
8. Mariposa Street/ Pennsylvania Avenue	3,300	3,700	3,300	3,200	3,700	3,600	15	24

/a/ Norman Steinman, Senior Associate, Barton-Aschman Associates, Inc., letter, August 14, 1987.
/b/ BAAQMD emission factors derived from ARB factors, version EMFAC7D.
/c/ Baseline intersection.

SOURCE: Baseline Environmental Consulting, Inc.

/5/ One-hour concentration = Eight-hour concentration divided by 0.7.

/6/ Norman Steinman, Senior Associate, Barton-Aschman Associates, Inc., telephone conversation, August 14, 1986.

/7/ Norman Steinman, Senior Associate, Barton-Aschman Associates, Inc., letter to Environmental Science Associates, Inc., July 30, 1986.

APPENDIX G. NOISE

Sound is the rapid fluctuation of air pressure at higher-than- and lower-than-normal atmospheric pressure. These fluctuations are produced by vibration or air turbulence and require a medium of both mass and elasticity in which to propagate. Sound energy travels in waves; the wavelength of the sound is the distance between successive pressure peaks. The intensity, or energy, of a sound at any given point is a function of the intensity of the sound at the source, the type of wave that the sound produced, the distance the wave traveled to the point of measurement, and any reflection, diffraction, refraction, or absorption of the energy that occurred along the way.

Sound energy radiates outward from a line (such as a road) or a point (such as a piledriver), producing plane or spherical waves, respectively. A line source -- for example, a stream of cars on a busy street -- produces composite sound waves that move out in parallel planes from the source (each individual car is a moving point source, but the net effect is a line source). A point source -- for example, the piledriver mentioned above -- produces sound waves that oscillate radially from the point of origin. The distinction between a line and a point source is important in calculation of the rate at which the sound produced by the source attenuates (decreases) as it spreads out from the source. Plane waves decrease in intensity by three decibels per doubling of distance from the source, whereas spherical waves will attenuate by six decibels per doubling of distance from the source.

Reflection of sound energy occurs when sound waves strike a solid surface and are reflected back toward their origin or forward. Examples of reflective surfaces are concrete and asphalt pavement, walls, berms, and vehicles. The sound waves striking the surface are "incident" and the sound energy reflected is "reflected." The direction of the sound waves movement is changed so that the angle of incidence equals the angle of reflection. Reflected and incident waves are additive inasmuch as their combined sound energy at a point results in an intensity greater than the contribution from the original source alone. Diffraction of sound waves occurs when sound waves bend around an obstacle or pass through an opening in an obstacle. The obstacle can be a wall or building, and the opening can be a crack in a door or window, or an open door or window.

The longer the wavelength of the sound relative to the obstacle the greater the amount of diffraction. Noise-shadow zones are areas where sound waves do not propagate, or they occur behind an obstacle as a result of diffraction. The areal extent of the noise-shadow zone is a function of the size of the obstacle and the wavelength of the sound. A large obstacle will produce a larger noise-shadow zone than a smaller obstacle exposed to the same wavelength. Refraction, the bending of sound waves, is caused by temperature and wind gradients in the air.

Temperature and wind gradients not only affect the direction that the sound wave travels, but also the speed at which different portions of the wave front travel. Sound waves tend to follow cooler air and, since cooler air is usually below warm air, a sound wave will bend down toward the cooler air and away from the warmer air. The portion of the wave front closest to the earth's surface, near the cooler air, will move faster than the portion of the wave front extending into the warmer air. Wind gradients can cause noise diffraction as well as produce noise-shadow zones. Wind speeds normally increase with altitude. Sound waves upwind from a noise source bend upward and form a shadow zone close to the earth's surface. Sound waves bend toward the earth's surface downwind, and, thus, no shadow zone forms.

Sound waves incident on a porous surface result in conversion of some of the sound (kinetic) energy into thermal energy. This energy conversion results in a reduction of sound energy, and is termed absorption. Draperies, acoustical tile and building insulation are some examples of absorptive materials that function in this manner. However, this conversion is rarely absolute; usually a certain percentage of the sound energy is transmitted through the substance.

The term 'noise' is often used to describe unwanted sound, and the perception of noise is a subjective matter because individual opinions vary as to what constitutes noise. Noise can be categorized into two types: background noise, which is a near-constant source of background sounds associated with a particular environment; and intrusive or peak noises, which are isolated events that stand out from background noise. The background noise environment is generated by a variety of constant or long-term noise sources that are within, close to and distant from a particular environment or location. The extent to which intrusive noise prevails over the background noise depends on its proximity, intensity, duration, frequency, and time of occurrence. Although both types of noise may affect the quality of life in a particular area, most environmental noise standards regulate constant background noise. The results of medical studies show that the primary cause of hearing loss is cumulative long-term exposure to excessive near-constant noise sources. Intrusive noise, although not generally a cause of permanent hearing loss, does contribute to stress, irritability, increased blood pressure, loss of sleep, and low work efficiency. The primary concerns in dealing with community and environmental noise are the effects of noise, both physical and psychological, on people, and on noise mitigation. To analyze noise effects and develop effective mitigation, noise must be measured and described, and then compared and evaluated in terms of set guidelines and regulations.

Noise intensity is measured in decibels (dB). A decibel is a logarithmic unit used to describe sound energy intensity mathematically. Because the human ear is more sensitive to some sound frequencies than others, environmental noise is customarily measured in "A-weighted" decibels, or dBA. "A"-weighting de-emphasizes the very low and very high frequency components of sound in a manner similar to the response of the human ear, and gives good correlation with subjective relations to noise. While sound energy and levels continually vary, the sound over a given period of time can be described on the basis of a single, equivalent level which contains an equal amount of sound energy as the actual, ever-varying sound level. This Equivalent Energy Level (L_{eq}) is typically computed over a one-, eight-, or 24-hour sample period. The threshold of human hearing is at about ten dBA; noise levels in a quiet library are about 40 dBA; normal speech (at three feet) is about 60 dBA; garbage disposals and electric blenders generate about 80 to 85 dBA (at five feet); and a pile driver produces about 105 dBA (at 50 feet). The Day Night Average Noise Level (L_{dn}) is an average noise level descriptor which covers a 24-hour period and takes into account the greater sensitivity that people have to night-time noise. With the (L_{dn}), ten decibels are added to measured, average noise levels between 10:00 p.m. and 7:00 a.m. to account for night-time effects. The U.S. Environmental Protection Agency (EPA) has established the Day-Night Average Noise Level (L_{dn}) as the accepted descriptor for cumulative exposure to background noise levels over a 24-hour period (see Note 7, p. VI.G.36). According to the EPA, a noise level of 55 dBA, L_{dn}, is the maximum acceptable to avoid interference with outdoor activities, and a level of 70 dBA, L_{dn}, is the maximum acceptable to avoid long-term hearing loss. The Community Noise Equivalent Level (CNEL), a measurement of average equivalent A-weighted sound during a 24-hour day, adds five dBA to sound levels between 7:00 p.m. to 10:00 p.m. and adds ten dBA to sound levels between 10:00 p.m. to 7:00 a.m. to account for noise sensitivity in evening and night hours.

A characteristic feature of the noise that people experience, particularly in an urban environment, is its variability. A helpful tool to understand and describe this variability is the maximum sound pressure level, L_{max}. The L_{max}, expressed in dBA, is the highest sound level pressure measured during a given sampling period.

Noise contours can be constructed to illustrate the spatial distribution of noise levels in a community or area. Contours can represent L_{eq}; CNEL; L_{dn}; or L_n, where "n" represents the percentage of the time that the noise exceeds a given level. Contour lines, joining equal sound pressure levels, are typically drawn in five- or ten-dB increments. These graphical representations are helpful in identifying areas where noise levels exceed standards, which in turn can target areas in need of mitigation.

Mitigation measures can include: constructing noise barriers to protect sensitive receptors from excessive noise levels; limiting noise-sensitive development in areas exceeding community noise standards and regulations; and locating new noise sources away from sensitive areas.

METHODOLOGY FOR COMPUTER ANALYSIS OF MISSION BAY TRAFFIC-RELATED NOISE IMPACTS

1. Setting

Total peak-hour vehicle volumes for 11 road segments were derived from VI.E. Transportation, Figure VI.E.3, p. VI.E.9. The traffic counts that generated these numbers were conducted in November of 1985 by Barton-Aschman Associates, Inc. (see Note 7, p. VI.E.232). These volumes were averaged when necessary to derive traffic volumes for multi-block segments, such as Townsend Street from Seventh to Third Streets. Truck percentages were taken from information provided by Barton-Aschman Associates, Inc., to Irene Kan, Baseline Environmental Consulting, in a letter dated August 14, 1987 (all trucks were assumed to be "heavy"). Vehicle speeds were also taken from the letter to Irene Kan, although the anticipated 25 miles per hour (mph) speed within the Project Area is below the minimum speed (31 mph) allowed by the model. These traffic volumes and speeds were used with the Federal Highway Administration (FHWA) computer model SNAP-1 to estimate peak-hour noise levels along the eleven road segments, as shown in Table XIV.G.1.

2. Impacts

Total peak-hour vehicle volumes at specific intersections for existing conditions and under the Alternatives for 2000 and 2020 were obtained from Barton-Aschman Associates, Inc. "Mission Bay EIR Vehicle Travel Demand Analysis," August 3, 1987, which is on file at the Department of City Planning, Office of Environmental Review. Road segment traffic volumes were derived from the intersection volumes by distributing traffic according to turning movements and summing the traffic volumes originating from opposite directions on the same segment.

Total traffic volumes were subdivided to represent heavy trucks (the same worst-case assumption applied in the Setting Analysis) and automobiles. This was done according to information provided in the previously referenced letter to Irene Kan from Barton-Aschman Associates, Inc. As for the Setting analysis, vehicle speeds provided by Barton-Aschman Associates, Inc. were used except within the Project Area, where the expected mid-block speed of 25 mph was below the minimum value that the computer model would accept. The lowest acceptable speed (31 mph) was used to model traffic noise on surface streets. On I-280, a speed

TABLE XIV.G.1: ESTIMATED EXISTING AFTERNOON PEAK-HOUR TRAFFIC NOISE LEVELS (L_{eq}) ON SELECTED STREET SEGMENTS, 1985

Street Segment	Vehicle Volume (vph)/a/ Autos	Trucks	Mid-Block Vehicle Speed (mph)	Peak-Hour Noise Level (dBA, L_{eq})
Third Street between Fourth and 16th Streets	2,465	185	31	74 /b/
Third Street between 16th and Mariposa Streets	2,370	180	31	73 /b/
Third Street between Fourth and Channel Streets	2,045	155	31	73 /b/
Third Street between Channel and Townsend Streets	1,755	195	31	74 /b/
Interstate 280 between Townsend and Mariposa Streets	4,900	150	45	72 /c/
Berry Street between Third and Fourth Streets	1,330	70	31	70 /b/
Mariposa Street between Mississippi and Illinois Streets	860	30	31	66 /b/
16th Street between Third and Mississippi Streets	460	40	31	67 /b/
Seventh Street between Townsend and King Streets	720	80	31	70 /b/
Fourth Street between Channel and Third Streets	815	60	31	69 /b/
Townsend Street between Seventh and Third Streets	864	35	31	67 /a/

/a/ Calculated from vehicle volumes given in VI.E. Transportation (see Figure VI.E.3, p. VI.E.9). All trucks were classified as "heavy." Derivation of segment-specific traffic volumes and truck percentages is described on p. XIV.G.3.
/b/ Reference distance 15 meters (49 feet).
/c/ Reference distance 50 meters (164 feet).

SOURCE: Environmental Science Associates, Inc.

of 45 mph, as assumed by Barton-Aschman Associates, Inc., was used. The segment-specific analysis was performed on the eleven segments individually using the FHWA model, SNAP1, as was performed for the Setting Analysis.

For the composite analysis of traffic noise impacts, the eleven road segments were laid out on a Cartesian coordinate system to identify the segment geometries. Roadway elevations were taken from a topographic site plan. A rectangular grid of noise receptors was arrayed over the Project Area. Additional noise receptors were positioned at the locations of the on-site monitoring conducted for the Setting Analysis (see receptors 25 through 32, Figure XIV.G.1.). Output from the computer model SNAP1, which is based on the FHWA highway noise prediction methods, provided composite peak-hour noise levels at each receptor, for each Alternative during 2000 and 2020, as well as existing conditions. The results of this modeling are shown in Table XIV.G.2.

Noise attenuation by intervening buildings was not accounted for in this analysis because of the complexity of accurately accounting for building placement, exterior dimensions, and materials of construction for such a large area, for multiple alternatives and analysis years. Where the placement of buildings clearly would attenuate noise levels from a specific source, such attenuation has been discussed in the analysis.

TABLE XIV.G.2: AREA-WIDE AFTERNOON PEAK-HOUR NOISE LEVELS (dBA, L_{eq})
PRODUCED BY VEHICULAR TRAFFIC

Receptor #	1985 Noise Levels	Noise Levels Estimated for 2000 Alternatives			Noise Levels Estimated for 2020 Alternatives		
		A	B	N	A	B	N
1.	71	69	69	69	70	69	71
2.	65	66	66	67	66	67	67
3.	65	67	66	67	67	67	$\underline{68}$
4.	65	67	66	67	67	67	$\underline{68}$
5.	67	69	69	$\underline{70}$	$\underline{70}$	$\underline{70}$	$\underline{71}$
6.	73	74	74	74	74	74	74
7.	65	66	66	66 /a/	66	66	67
8.	63	65 /a/	65 /a/	66 /a/	65 /a/	65 /a/	66 /a/
9.	65	$\underline{68}$	$\underline{68}$	$\underline{68}$	$\underline{68}$	$\underline{68}$	$\underline{69}$
10.	68	$\underline{71}$	$\underline{71}$	$\underline{72}$	$\underline{72}$	$\underline{72}$	$\underline{73}$
11.	70	71	71	71	71	71	71
12.	69	70	70	71	70	70	70
13.	65	67	67	67	67	67	$\underline{68}$
14.	65	$\underline{68}$	$\underline{68}$	$\underline{69}$	$\underline{69}$	$\underline{68}$	$\underline{70}$
15.	68	$\underline{72}$	$\underline{72}$	$\underline{73}$	$\underline{73}$	$\underline{72}$	$\underline{74}$
16.	62	$\underline{65}$	$\underline{66}$	$\underline{66}$ /a/	$\underline{65}$ /a/	$\underline{65}$ /a/	$\underline{67}$
17.	74	75	75	76	75	75	76
18.	68	$\underline{71}$	70	$\underline{71}$	$\underline{71}$	$\underline{71}$	$\underline{71}$
19.	67	$\underline{70}$	$\underline{70}$	$\underline{71}$	$\underline{71}$	$\underline{71}$	$\underline{72}$
20.	68	$\underline{72}$	$\underline{72}$	$\underline{73}$	$\underline{72}$	$\underline{72}$	$\underline{74}$
21.	61 /a/	$\underline{65}$ /a/	$\underline{65}$ /a/	$\underline{66}$ /a/	$\underline{65}$ /a/	$\underline{65}$ /a/	$\underline{67}$
22.	78 /b/	79 /b/	79 /b/	79 /b/	79 /b/	79 /b/	80 /b/
23.	67	$\underline{73}$	$\underline{73}$	$\underline{74}$	$\underline{73}$	$\underline{72}$	$\underline{75}$
24.	68	$\underline{73}$	$\underline{73}$	$\underline{74}$	$\underline{73}$	$\underline{72}$	$\underline{75}$
25.	72	74	74	$\underline{75}$	$\underline{75}$	$\underline{75}$	$\underline{76}$
26.	71	72	72	73	73	73	$\underline{74}$
27.	68	69	70	70	69	69	70
28.	63	$\underline{66}$	$\underline{66}$	$\underline{67}$	$\underline{66}$	$\underline{66}$	$\underline{68}$
29.	71	$\underline{75}$	$\underline{75}$	$\underline{76}$	$\underline{76}$	$\underline{76}$	$\underline{77}$
30.	66	68	68	$\underline{69}$	$\underline{69}$	$\underline{69}$	$\underline{70}$
31.	68	69	69	70	69	69	70
32.	64	66	66	66	66	66	67

NOTE: Underlined values are noticeably louder (at least three dBA greater) than existing conditions. Model input data and assumptions are on file at the Department of City Planning, Office of Environmental Review. Receptor numbers refer to locations shown in Figure XIV.G.1.

/a/ Lowest noise level for Alternative.
/b/ Highest noise level for Alternative.

SOURCE: Environmental Science Associates, Inc.

MISSION BAY BOUNDARY

Mission Bay

SOURCE: Environmental Science Associates, Inc.

FIGURE XIV.G.1
LOCATIONS OF RECEPTORS
USED IN NOISE MODELING

TABLE XIV.H.1: EXISTING ANNUAL OPERATIONAL ENERGY CONSUMPTION, 1985/a/

Land Use	Electricity Consumption Factor (kWh/Sq. Ft.-Year)	Natural Gas Consumption Factor (Cu. Ft./Sq. Ft.-Year)	Building Floor Area (Sq. Ft.)	Annual Energy Consumption Electricity (kWh)	Annual Energy Consumption Natural Gas (Cu. Ft.)	Annual Energy Consumption Total (Btu. in millions)/b/
Office	16.1	40.6	32,000	515,000	1,300,000	6,700
Retail	13.1	16.6	44,400	582,000	737,000	6,770
Restaurant	37.5	195.6	6,580	247,000	1,290,000	3,940
Storage	6.3	12.6	1,330,000	8,380,000	16,800,000	104,000
Manufacturing/Construction/c/	18.1	185.2	86,000	1,560,000	15,900,000	33,500
Miscellaneous	13.3	42.9	24,000	319,000	1,030,000	4,400
TOTAL			1,523,000	11,600,000	37,000,000	159,000

NOTE: Totals may not add due to rounding.

/a/ Based on commercial energy consumption factors from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), and floor area projections contained in Chapter VI.B. Land Use and Planning. Consumption factors are for 1980 (which reflect pre-Title 24 State Energy Conservation Standards buildings) to account for the older building stock in the Project Area.

/b/ Based on the following conversion factors:
Electricity = 10,239 Btu/kWh (at source);
Natural Gas = 1,100 Btu/cubic foot (at source).

/c/ For the manufacturing/construction uses, estimates of energy consumption are based on the number of employees, rather than on floor area. The energy intensity of manufacturing/construction uses is approximately 120 million Btu/employee/year (Federal Energy Administration, 1977, The Planner's Energy Workbook); there are 177 employees in the manufacturing/construction sector in the Project Area. It is assumed that 25% of the energy is supplied by electricity (8,790 kWh/employee/year) and 75% is supplied by natural gas (90,000 cubic feet/employee/year). For consistency, energy consumption factors for construction/manufacturing are presented in the table on a per-square-foot basis.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.2: TOTAL CONSTRUCTION ENERGY CONSUMPTION, ALTERNATIVE A, 1986-2000 AND 1986-2020/a/

1986-2000	Construction Energy Consumption Factor (Btu/Sq. Ft.)	Floor Area of New Construction (Sq. Ft.)	Construction Energy Consumption (Btu, in millions)/b/
Land Use			
Office	1,640,000	1,440,000	2,360,000
S/LI/RD	970,000	1,330,000	1,290,000
Retail	940,000	50,000	47,000
Hotel	1,230,000	400,000	492,000
Community Facilities	1,450,000	37,000	53,700
Train Station	1,450,000	10,000	14,500
Residential	650,000	2,420,000	1,570,000
	(Btu/Linear Ft.)	(Street Length, Ft.)	
Infrastructure/c/	7,160,000	29,200	209,000
TOTAL			6,040,000

1986-2020	Construction Energy Consumption Factor (Btu/Sq. Ft.)	Floor Area of New Construction (Sq. Ft.)	Construction Energy Consumption (Btu, in millions)/b/
Land Use			
Office	1,640,000	4,100,000	6,720,000
S/LI/RD	970,000	3,600,000	3,490,000
Retail	940,000	250,000	235,000
Hotel	1,230,000	400,000	492,000
Community Facilities	1,450,000	125,000	181,000
Train Station	1,450,000	10,000	15,000
Residential	650,000	6,550,000	4,250,000
	(Btu/Linear Ft.)	(Street Length, Ft.)	
Infrastructure/c/	7,160,000	33,200	238,000
TOTAL			15,600,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on construction energy consumption factors contained in Hannon, B., et al., 1978, "Energy and Labor in the Construction Sector," Science 202:837-847, floor area projections contained in Chapter V. The EIR Alternatives and Approval Process, and infrastructure construction energy data from Interactive Resources, Inc., Energy Conservation: Guidelines for Evaluating New Development in Contra Costa County, California, 1976.
/b/ Construction energy consumption includes direct energy consumed through construction and indirect energy embodied in the various materials used.
/c/ Infrastructure includes streets, sewers, storm drains, water supply, electrical service, natural gas service, and telephone service. Infrastructure construction energy consumption is related to street length; street lengths from Figures V.1 and V.4, pp. V.8 and V.33, are used as an index to energy consumption for construction of infrastructure.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.3: TOTAL CONSTRUCTION ENERGY CONSUMPTION, ALTERNATIVE B, 1986-2000 AND 1986-2020/a/

1986-2000	Construction Energy Consumption Factor (Btu/Sq. Ft.)	Floor Area of New Construction (Sq. Ft.)	Construction Energy Consumption (Btu. in millions)/b/
Land Use			
Office	1,640,000	1,000,000	1,640,000
Retail	940,000	40,000	37,600
Community Facilities	1,450,000	42,000	60,900
Train Station	1,450,000	10,000	14,500
Residential	650,000	2,330,000	1,510,000
	(Btu/Linear Ft.)	(Street Length, Ft.)	
Infrastructure/c/	7,160,000	23,800	170,000
TOTAL			3,440,000
1986-2020	**Construction Energy Consumption Factor (Btu/Sq. Ft.)**	**Floor Area of New Construction (Sq. Ft.)**	**Construction Energy Consumption (Btu. in millions)/b/**
Land Use			
Office	1,640,000	1,000,000	1,640,000
S/LI/RD	970,000	420,000	407,000
Retail	940,000	300,000	282,000
Community Facilities	1,450,000	293,000	425,000
Train Station	1,450,000	10,000	14,500
Residential	650,000	8,500,000	5,530,000
	(Btu/Linear Ft.)	(Street Length, Ft.)	
Infrastructure/c/	7,160,000	31,800	228,000
TOTAL			8,520,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on construction energy consumption factors contained in Hannon, B., et al., 1978, "Energy and Labor in the Construction Sector," Science 202:837-847, floor area projections contained in Chapter V. The EIR Alternatives and Approval Process, and infrastructure construction energy data from Interactive Resources, Inc., Energy Conservation: Guidelines for Evaluating New Development in Contra Costa County, California, 1976.
/b/ Construction energy consumption includes direct energy consumed through construction and indirect energy embodied in the various materials used.
/c/ Infrastructure includes streets, sewers, storm drains, water supply, electrical service, natural gas service, and telephone service. Infrastructure construction energy consumption is related to street length; street lengths from Figures V.2 and V.5, pp. V.9 and V.34, are used as an index to energy consumption for construction of infrastructure.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.4: TOTAL CONSTRUCTION ENERGY CONSUMPTION, ALTERNATIVE N, 1986-2000 AND 1986-2020/a/

1986-2000	Construction Energy Consumption Factor (Btu/Sq. Ft.)	Floor Area of New Construction (Sq. Ft.)	Construction Energy Consumption (Btu, in millions)/b/
Land Use			
Office	1,640,000	1,000,000	1,640,000
M-2 Industrial	970,000	550,000	534,000
Retail	940,000	65,000	61,100
	(Btu/Linear Ft.)	(Street Length, Ft.)	
Infrastructure/c/	7,160,000	16,200	116,000
TOTAL			2,350,000
1986-2020	**Construction Energy Consumption Factor (Btu/Sq. Ft.)**	**Floor Area of New Construction (Sq. Ft.)**	**Construction Energy Consumption (Btu, in millions)/b/**
Land Use			
Office	1,640,000	1,000,000	1,640,000
M-2 Industrial	970,000	5,000,000	4,850,000
Retail	940,000	100,000	94,000
Community Facilities	1,450,000	42,000	60,900
Port-Related/M-2	970,000	1,048,000	1,020,000
	(Btu/Linear Ft.)	(Street Length, Ft.)	
Infrastructure/c/	7,160,000	33,000	236,000
TOTAL			7,900,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on construction energy consumption factors contained in Hannon, B., et al., 1978, "Energy and Labor in the Construction Sector," Science 202:837-847, floor area projections contained in Chapter V. The EIR Alternatives and Approval Process, and infrastructure construction energy data from Interactive Resources, Inc., Energy Conservation: Guidelines for Evaluating New Development in Contra Costa County, California, 1976.

/b/ Construction energy consumption includes direct energy consumed through construction and indirect energy embodied in the various materials used.

/c/ Infrastructure includes streets, sewers, storm drains, water supply, electrical service, natural gas service, and telephone service. Infrastructure construction energy consumption is related to street length; street lengths from Figures V.3 and V.6, pp. V.20 and V.35, are used as an index to energy consumption for construction of infrastructure.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.5: ANNUAL OPERATIONAL ENERGY CONSUMPTION, ALTERNATIVE A, 2000/a/

Land Use	Electricity Consumption Factor (kWh/Sq. Ft.-Year)	Natural Gas Consumption Factor (Cu. Ft./Sq. Ft.-Year)	Building Floor Area (Sq. Ft.)	Annual Energy Consumption: Electricity (kWh)	Annual Energy Consumption: Natural Gas (Cu. Ft.)	Annual Energy Consumption: Total (Btu. in millions)/b/
Commercial						
Office	16.1	20.9	1,440,000	23,200,000	30,100,000	270,000
S/LI/RD	16.1	20.9	1,330,000	21,400,000	27,800,000	250,000
Retail	11.1	11.6	50,000	555,000	580,000	6,320
Hotel	9.0	49.7	400,000	3,600,000	19,900,000	58,700
Community Facilities	6.0	41.5	37,000	222,000	1,540,000	3,960
Train Station	6.0	41.5	10,000	60,000	415,000	1,070
Pump Station	6.0	41.5	12,000	72,000	498,000	1,290
Existing Remaining	12.0	30.8	440,000	5,280,000	13,600,000	69,000
TOTAL COMMERCIAL			3,719,000	54,400,000	94,400,000	661,000
Residential	(kWh/Unit-Year)	(Cu. Ft./Unit-Year)	(Units)			
Standard Residence	2,500 /c/	47,000 /c/	2,850	7,130,000	134,000,000	220,000
Houseboat	1,250 /d/	0 /d/	20	25,000	0	256
TOTAL RESIDENTIAL			2,870	7,150,000	134,000,000	220,000
TOTAL				61,500,000	228,000,000	881,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on commercial energy consumption factors as adapted from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), residential energy consumption factors from San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor area projections contained in Chapter V. The EIR Alternatives and Approval Process.
/b/ Energy conversion factors: Electricity = 10,239 Btu/kWh (at-source); Natural Gas = 1,100 Btu/cubic foot (at-source).
/c/ Residential energy consumption factors are lower than those used in the San Francisco Downtown Plan EIR because residential units would be in multi-family buildings (and thus would be more energy efficient), and Title 24 standards would reduce natural gas consumption for space and water heating by 10% compared to 1980 consumption levels.
/d/ Houseboats are assumed to consume one-half of the electricity consumed by an average residence and no natural gas.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.6: ANNUAL OPERATIONAL ENERGY CONSUMPTION, ALTERNATIVE B, 2000/a/

Land Use	Electricity Consumption Factor (kWh/Sq. Ft.-Year)	Natural Gas Consumption Factor (Cu. Ft./Sq. Ft.-Year)	Building Floor Area (Sq. Ft.)	Annual Energy Consumption: Electricity (kWh)	Annual Energy Consumption: Natural Gas (Cu. Ft.)	Annual Energy Consumption: Total (Btu, in millions)/b/
Commercial						
Office	16.1	20.9	1,000,000	16,100,000	20,900,000	188,000
Retail	11.1	11.6	40,000	444,000	464,000	5,060
Community Facilities	6.0	41.5	42,000	252,000	1,740,000	4,500
Train Station	6.0	41.5	10,000	60,000	415,000	1,070
Pump Station	6.0	41.5	12,000	72,000	498,000	1,290
Existing Remaining	12.0	30.8	661,000	7,930,000	20,400,000	104,000
TOTAL COMMERCIAL			1,765,000	24,900,000	44,400,000	303,000
Residential	(kWh/Unit-Year)	(Cu. Ft./Unit-Year)	(Units)			
Standard Residence	2,500 /c/	47,000 /c/	2,740	6,850,000	129,000,000	212,000
Houseboat	1,250 /d/	0 /d/	20	25,000	0	256
TOTAL RESIDENTIAL			2,760	6,880,000	129,000,000	212,000
TOTAL				31,700,000	173,000,000	515,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on commercial energy consumption factors as adapted from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), residential energy consumption factors from San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor area projections contained in Chapter V. The EIR Alternatives and Approval Process.
/b/ Energy conversion factors: Electricity = 10,239 Btu/kWh (at-source); Natural Gas = 1,100 Btu/cubic foot (at-source).
/c/ Residential energy consumption factors are lower than those used in the San Francisco Downtown Plan EIR because residential units would be in multi-family buildings (and thus would be more energy efficient), and Title 24 standards would reduce natural gas consumption for space and water heating by 10% compared to 1980 consumption levels.
/d/ Houseboats are assumed to consume one-half of the electricity consumed by an average residence and no natural gas.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.7: ANNUAL OPERATIONAL ENERGY CONSUMPTION, ALTERNATIVE N, 2000/a/

Land Use	Electricity Consumption Factor (kWh/Sq. Ft.-Year)	Natural Gas Consumption Factor (Cu. Ft./Sq. Ft.-Year)	Building Floor Area (Sq. Ft.)	Annual Energy Consumption: Electricity (kWh)	Annual Energy Consumption: Natural Gas (Cu. Ft.)	Annual Energy Consumption: Total (Btu, in millions)/b/
Commercial						
Office	16.1	20.9	1,000,000	16,100,000	20,900,000	188,000
Retail	11.1	11.6	65,000	722,000	754,000	8,220
M-2 Industrial	12.0	30.8	550,000	6,600,000	16,900,000	86,200
Train Station	6.0	41.5	10,000	60,000	415,000	1,070
Pump Station	6.0	41.5	12,000	72,000	498,000	1,290
Existing Remaining	12.0	30.8	1,380,000	16,500,000	42,400,000	216,000
TOTAL COMMERCIAL			3,010,000	40,100,000	81,900,000	500,000
Residential	(kWh/Unit-Year)	(Cu. Ft./Unit-Year)	(Units)			
Houseboat	1,250 /c/	0 /c/	20	25,000	0	256
TOTAL RESIDENTIAL			20	25,000	0	256
TOTAL				40,100,000	81,900,000	500,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on commercial energy consumption factors as adapted from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), residential energy consumption factors from San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor area projections contained in Chapter V. The EIR Alternatives and Approval Process.
/b/ Energy conversion factors: Electricity = 10,239 Btu/kWh (at-source); Natural Gas = 1,100 Btu/cubic foot (at-source).
/c/ Houseboats are assumed to consume one-half of the electricity consumed by an average residence and no natural gas.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.8: ANNUAL OPERATIONAL ENERGY CONSUMPTION, ALTERNATIVE A, BUILD-OUT/2020/a/

Land Use	Electricity Consumption Factor (kWh/Sq. Ft.-Year)	Natural Gas Consumption Factor (Cu. Ft./Sq. Ft.-Year)	Building Floor Area (Sq. Ft.)	Annual Energy Consumption: Electricity (kWh)	Annual Energy Consumption: Natural Gas (Cu. Ft.)	Annual Energy Consumption: Total (Btu, in millions)/b/
Commercial						
Office	16.5	17.1	4,100,000	67,700,000	70,100,000	770,000
S/LI/RD	16.5	17.1	3,600,000	59,400,000	61,600,000	676,000
Retail	10.5	8.3	250,000	2,630,000	2,080,000	29,200
Hotel	9.4	42.2	400,000	3,760,000	16,900,000	57,100
Community Facilities	6.3	38.7	125,000	788,000	4,840,000	13,400
Train Station	6.3	38.7	10,000	63,000	387,000	1,070
Pump Station	6.3	38.7	12,000	75,600	464,000	1,290
TOTAL COMMERCIAL			8,497,000	134,000,000	156,000,000	1,550,000
Residential	(kWh/Unit-Year)	(Cu. Ft./Unit-Year)	(Units)			
Standard Residence	2,500 /c/	47,000 /c/	7,700	19,300,000	362,000,000	595,000
Houseboat	1,250 /d/	0 /d/	20	25,000	0	256
TOTAL RESIDENTIAL			7,720	19,300,000	362,000,000	595,000
TOTAL				154,000,000	518,000,000	2,140,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on commercial energy consumption factors as adapted from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), residential energy consumption factors from San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor area projections contained in Chapter V. The EIR Alternatives and Approval Process.

/b/ Energy conversion factors: Electricity = 10,239 Btu/kWh (at-source); Natural Gas = 1,100 Btu/cubic foot (at-source).

/c/ Residential energy consumption factors are lower than those used in the San Francisco Downtown Plan EIR because residential units would be in multi-family buildings (and thus would be more energy efficient), and Title 24 standards would reduce natural gas consumption for space and water heating by 10% compared to 1980 consumption levels.

/d/ Houseboats are assumed to consume one-half of the electricity consumed by an average residence and no natural gas.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.9: ANNUAL OPERATIONAL ENERGY CONSUMPTION, ALTERNATIVE B, BUILD-OUT/2020/a/

Land Use	Electricity Consumption Factor (kWh/Sq. Ft.-Year)	Natural Gas Consumption Factor (Cu. Ft./Sq. Ft.-Year)	Building Floor Area (Sq. Ft.)	Annual Energy Consumption: Electricity (kWh)	Annual Energy Consumption: Natural Gas (Cu. Ft.)	Annual Energy Consumption: Total (Btu. in millions)/b/
Commercial						
Office	16.5	17.1	1,000,000	16,500,000	17,100,000	188,000
S/LI/RD	16.5	17.1	420,000	6,930,000	7,180,000	78,900
Retail	10.5	8.3	300,000	3,150,000	2,490,000	35,000
Community Facilities	6.3	38.7	293,000	1,850,000	11,300,000	31,400
Train Station	6.3	38.7	10,000	63,000	387,000	1,070
Pump Station	6.3	38.7	12,000	75,600	464,000	1,290
TOTAL COMMERCIAL			2,035,000	28,600,000	39,000,000	335,000
Residential	(kWh/Unit-Year)	(Cu. Ft./Unit-Year)	(Units)			
Standard Residence	2,500 /c/	47,000 /c/	10,000	25,000,000	470,000,000	773,000
Houseboat	1,250 /d/	0 /d/	20	25,000	0	256
TOTAL RESIDENTIAL			10,020	25,000,000	470,000,000	773,000
TOTAL				53,600,000	509,000,000	1,110,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on commercial energy consumption factors as adapted from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), residential energy consumption factors from the San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor area projections contained in Chapter V. The EIR Alternatives and Approval Process.
/b/ Energy conversion factors: Electricity = 10,239 Btu/kWh (at-source); Natural Gas = 1,100 Btu/cubic foot (at-source).
/c/ Residential energy consumption factors are lower than those used in the San Francisco Downtown Plan EIR because residential units would be in multi-family buildings (and thus would be more energy efficient), and Title 24 standards would reduce natural gas consumption for space and water heating by 10% compared to 1980 consumption levels.
/d/ Houseboats are assumed to consume one-half of the electricity consumed by an average residence and no natural gas.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.10: ANNUAL OPERATIONAL ENERGY CONSUMPTION, ALTERNATIVE N, BUILD-OUT/2020/a/

Land Use	Electricity Consumption Factor (kWh/Sq. Ft.-Year)	Natural Gas Consumption Factor (Cu. Ft./Sq. Ft.-Year)	Building Floor Area (Sq. Ft.)	Annual Energy Consumption: Electricity (kWh)	Annual Energy Consumption: Natural Gas (Cu. Ft.)	Annual Energy Consumption: Total (Btu. in millions)/b/
Commercial						
Office	16.5	17.1	1,000,000	16,500,000	17,100,000	188,000
Retail	10.5	8.3	100,000	1,050,000	830,000	11,700
M-2 Industrial	12.5	26.2	5,000,000	62,500,000	131,000,000	784,000
Port-Related/M-2	12.5	26.2	1,050,000	13,100,000	27,500,000	164,000
Community Facilities	6.3	38.7	42,000	265,000	1,625,000	4,500
Train Station	6.3	38.7	10,000	63,000	387,000	1,070
Pump Station	6.3	38.7	12,000	75,600	464,000	1,290
TOTAL COMMERCIAL			7,210,000	93,600,000	179,000,000	1,150,000
Residential	(kWh/Unit-Year)	(Cu. Ft./Unit-Year)	(Units)			
Houseboat	1,250 /c/	0 /c/	20	25,000	0	256
TOTAL RESIDENTIAL			20	25,000	0	256
TOTAL				93,600,000	179,000,000	1,150,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on commercial energy consumption factors as adapted from unpublished information provided by the California Energy Commission (Hoang Dang Nguyen, Research Economist, California Energy Commission, April 24, 1987), residential energy consumption factors from the San Francisco Department of City Planning, Energy Conservation Potential for Natural Gas and Electricity: 1980-1990, 1981, and floor area projections contained in Chapter V. The EIR Alternatives and Approval Process.

/b/ Energy conversion factors: Electricity = 10,239 Btu/kWh (at-source); Natural Gas = 1,100 Btu/cubic foot (at-source).

/c/ Houseboats are assumed to consume one-half of the electricity consumed by an average residence and no natural gas.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.11: PEAK ELECTRICAL DEMAND BY ALTERNATIVE, 2000/a/

		Peak Electrical Demand (kW)		
Land Use	Load Factor	Alternative A	Alternative B	Alternative N
Commercial				
Office	0.38	6,970	4,840	4,840
S/LI/RD	0.38	6,430	0	0
Retail	0.18	352	282	458
Hotel	0.47	874	0	0
M-2 Industrial	0.47	0	0	1,600
Community Facilities	0.44	58	65	0
Train Station	0.47	15	15	15
Pump Station	0.47	17	17	17
Existing Remaining	0.47	1,280	1,930	4,010
TOTAL COMMERCIAL		16,000	7,140	10,900
Residential				
Standard Residence	0.47	1,730	1,660	0
Houseboat	0.47	6	6	6
TOTAL RESIDENTIAL		1,740	1,670	6
TOTAL		17,700	8,810	10,900

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on total projected energy consumption (see Tables XIV.H.5-XIV.H.7, pp. XIV.H.5-XIV.H.7) and load factors from PG&E, 1985 Class Load Study, February 1987.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.12: PEAK ELECTRICAL DEMAND BY ALTERNATIVE, BUILD-OUT/2020/a/

Land Use	Load Factor	Peak Electrical Demand (kW) Alternative A	Alternative B	Alternative N
Commercial				
Office	0.38	20,300	4,960	4,960
S/LI/RD	0.38	17,800	2,080	0
Retail	0.18	1,670	2,000	666
Hotel	0.47	913	0	0
M-2 Industrial	0.47	0	0	15,200
Port-Related/M-2	0.47	0	0	3,180
Community Facilities	0.44	204	479	69
Train Station	0.47	15	15	15
Pump Station	0.47	18	18	18
TOTAL COMMERCIAL		41,000	9,550	24,100
Residential				
Standard Residence	0.47	4,680	6,070	0
Houseboat	0.47	6	6	6
TOTAL RESIDENTIAL		4,680	6,080	6
TOTAL		45,700	15,600	24,100

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on total projected energy consumption (see Tables XIV.H.8-XIV.H.10, pp. XIV.H.8-XIV.H.10) and load factors from PG&E, 1985 Class Load Study, February 1987.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.13: ANNUAL TRANSPORTATION ENERGY CONSUMPTION, ALTERNATIVE A, 2000

Mode	Annual Miles Traveled (in millions)/a/	Energy Consumption Factor (Btu/Mile)	Annual Energy Consumption: Gasoline (Gals.)	Diesel (Gals.)	Electricity (kWh)	Btu (in millions)
Auto	205	4,400 /b/	5,380,000	881,000	--	903,000
MUNI	23.1	2,900 /c/	--	228,000	3,240,000	66,900
BART	71.0	2,400 /d/	--	--	16,600,000	170,000
AC Transit	25.6	3,200 /e/	--	554,000	--	81,800
CalTrain	8.01	3,000 /e/	--	163,000	--	24,000
SamTrans	4.04	3,200 /e/	--	87,400	--	12,900
Golden Gate Bus	14.9	3,200 /e/	--	323,000	--	47,700
Golden Gate Ferry	2.47	1,600 /e/	--	26,800	--	3,960
TOTAL			5,380,000	2,260,000	19,800,000	1,310,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on estimates of project-related passenger and vehicle trips, modal splits, and geographic distribution of trips developed in the transportation analysis. Miles shown are vehicle-miles for autos and passenger-miles for all other modes. Daily trips were multiplied by 295 "workday equivalents" per year to obtain annual trips.

/b/ Based on fuel efficiency projections and percent diesel estimates from Caltrans, 1983, Energy and Transportation Systems. Fuel consumption rates were converted from miles-per-gallon to Btu/mile using the projected mix of gasoline and diesel and their at-source energy contents (143,700 Btu/gallon for gasoline and 147,600 Btu/gallon for diesel).

/c/ Based on the system-wide average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from MUNI, 1986, Urban Mass Transit Section 15 Reporting Requirements Year Ending June 30, 1986. Energy consumption was converted from diesel and electricity to Btu using at-source energy contents of 147,600 Btu/gallon and 10,239 Btu/kWh, respectively.

/d/ Based on average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from Bay Area Rapid Transit District, 1986, Quarterly Performance Report July-September 1986. Electrical consumption was converted to Btu using the at-source energy content of 10,239 Btu/kWh.

/e/ Based on average energy consumption per passenger-mile for various modes of transit as contained in Oak Ridge National Laboratory, 1985, Transportation Energy Data Book: Edition 8.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.14: ANNUAL TRANSPORTATION ENERGY CONSUMPTION, ALTERNATIVE B, 2000

Mode	Annual Miles Traveled (in millions)/a/	Energy Consumption Factor (Btu/Mile)	Annual Energy Consumption: Gasoline (Gals.)	Diesel (Gals.)	Electricity (kWh)	Btu (in millions)
Auto	114	4,400 /b/	2,980,000	489,000	--	501,000
MUNI	14.1	2,900 /c/	--	139,000	1,980,000	40,800
BART	36.4	2,400 /d/	--	--	8,530,000	87,300
AC Transit	12.3	3,200 /e/	--	267,000	--	39,400
CalTrain	4.70	3,000 /e/	--	95,500	--	14,100
SamTrans	1.90	3,200 /e/	--	41,200	--	6,080
Golden Gate Bus	7.25	3,200 /e/	--	157,000	--	23,200
Golden Gate Ferry	1.16	1,600 /e/	--	12,600	--	1,860
TOTAL			2,980,000	1,200,000	10,500,000	714,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on estimates of project-related passenger and vehicle trips, modal splits, and geographic distribution of trips developed in the transportation analysis. Miles shown are vehicle-miles for autos and passenger-miles for all other modes. Daily trips were multiplied by 295 "workday equivalents" per year to obtain annual trips.

/b/ Based on fuel efficiency projections and percent diesel estimates from Caltrans, 1983, Energy and Transportation Systems. Fuel consumption rates were converted from miles-per-gallon to Btu/mile using the projected mix of gasoline and diesel and their at-source energy contents (143,700 Btu/gallon for gasoline and 147,600 Btu/gallon for diesel).

/c/ Based on the system-wide average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from MUNI, 1986, Urban Mass Transit Section 15 Reporting Requirements Year Ending June 30, 1986. Energy consumption was converted from diesel and electricity to Btu using at-source energy contents of 147,600 Btu/gallon and 10,239 Btu/kWh, respectively.

/d/ Based on average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from Bay Area Rapid Transit District, 1986, Quarterly Performance Report July-September 1986. Electrical consumption was converted to Btu using the at-source energy content of 10,239 Btu/kWh.

/e/ Based on average energy consumption per passenger-mile for various modes of transit as contained in Oak Ridge National Laboratory, 1985, Transportation Energy Data Book: Edition 8.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.15: ANNUAL TRANSPORTATION ENERGY CONSUMPTION, ALTERNATIVE N, 2000

Mode	Annual Miles Traveled (in millions)/a/	Energy Consumption Factor (Btu/Mile)	Annual Energy Consumption: Gasoline (Gals.)	Diesel (Gals.)	Electricity (kWh)	Btu (in millions)
Auto	129	4,400 /b/	3,370,000	552,000	--	566,000
MUNI	4.67	2,900 /c/	--	46,100	656,000	13,600
BART	18.5	2,400 /d/	--	--	4,330,000	44,300
AC Transit	7.17	3,200 /e/	--	155,000	--	22,900
CalTrain	1.74	3,000 /e/	--	35,300	--	5,210
SamTrans	1.16	3,200 /e/	--	25,100	--	3,710
Golden Gate Bus	4.14	3,200 /e/	--	89,400	--	13,200
Golden Gate Ferry	.710	1,600 /e/	--	7,720	--	1,140
TOTAL			3,370,000	911,000	4,990,000	671,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on estimates of project-related passenger and vehicle trips, modal splits, and geographic distribution of trips developed in the transportation analysis. Miles shown are vehicle-miles for autos and passenger-miles for all other modes. Daily trips were multiplied by 295 "workday equivalents" per year to obtain annual trips.

/b/ Based on fuel efficiency projections and percent diesel estimates from Caltrans, 1983, Energy and Transportation Systems. Fuel consumption rates were converted from miles-per-gallon to Btu/mile using the projected mix of gasoline and diesel and their at-source energy contents (143,700 Btu/gallon for gasoline and 147,600 Btu/gallon for diesel).

/c/ Based on the system-wide average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from MUNI, 1986, Urban Mass Transit Section 15 Reporting Requirements Year Ending June 30, 1986. Energy consumption was converted from diesel and electricity to 8tu using at-source energy contents of 147,600 Btu/gallon and 10,239 Btu/kWh, respectively.

/d/ Based on average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from Bay Area Rapid Transit District, 1986, Quarterly Performance Report July-September 1986. Electrical consumption was converted to Btu using the at-source energy content of 10,239 8tu/kWh.

/e/ Based on average energy consumption per passenger-mile for various modes of transit as contained in Oak Ridge National Laboratory, 1985, Transportation Energy Data Book: Edition 8.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.16: ANNUAL TRANSPORTATION ENERGY CONSUMPTION, ALTERNATIVE A, BUILD-OUT/2020

Mode	Annual Miles Traveled (in millions)/a/	Energy Consumption Factor (Btu/Mile)	Annual Energy Consumption: Gasoline (Gals.)	Diesel (Gals.)	Electricity (kWh)	Btu (in millions)
Auto	441	4,200 /b/	11,000,000	1,870,000	--	1,850,000
MUNI	49.8	2,900 /c/	--	491,000	6,990,000	144,000
BART	146	2,400 /d/	--	--	34,300,000	351,000
AC Transit	51.7	3,200 /e/	--	1,120,000	--	165,000
CalTrain	17.9	3,000 /e/	--	363,000	--	53,600
SamTrans	8.54	3,200 /e/	--	185,000	--	27,300
Golden Gate Bus	32.2	3,200 /e/	--	698,000	--	103,000
Golden Gate Ferry	5.29	1,600 /e/	--	57,300	--	8,460
TOTAL			11,000,000	4,780,000	41,300,000	2,700,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on estimates of project-related passenger and vehicle trips, modal splits, and geographic distribution of trips developed in the transportation analysis. Miles shown are vehicle-miles for autos and passenger-miles for all other modes. Daily trips were multiplied by 295 "workday equivalents" per year to obtain annual trips.

/b/ Based on fuel efficiency projections and percent diesel estimates from Caltrans, 1983, Energy and Transportation Systems. Fuel consumption rates were converted from miles-per-gallon to Btu/mile using the projected mix of gasoline and diesel and their at-source energy contents (143,700 Btu/gallon for gasoline and 147,600 Btu/gallon for diesel). Year 2005 projections are the latest available projections and were used for the year 2020 consumption factor.

/c/ Based on the system-wide average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from MUNI, 1986, Urban Mass Transit Section 15 Reporting Requirements Year Ending June 30, 1986. Energy consumption was converted from diesel and electricity to Btu using at-source energy contents of 147,600 Btu/gallon and 10,239 Btu/kWh, respectively.

/d/ Based on average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from Bay Area Rapid Transit District, 1986, Quarterly Performance Report July-September 1986. Electrical consumption was converted to Btu using the at-source energy content of 10,239 Btu/kWh.

/e/ Based on average energy consumption per passenger-mile for various modes of transit as contained in Oak Ridge National Laboratory, 1985, Transportation Energy Data Book: Edition 8.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.17: ANNUAL TRANSPORTATION ENERGY CONSUMPTION, ALTERNATIVE B, BUILD-OUT/2020

			Annual Energy Consumption			
Mode	Annual Miles Traveled (in millions)/a/	Energy Consumption Factor (Btu/Mile)	Gasoline (Gals.)	Diesel (Gals.)	Electricity (kWh)	Btu (in millions)
Auto	266	4,200 /b/	6,630,000	1,130,000	--	1,120,000
MUNI	36.4	2,900 /c/	--	359,000	5,110,000	105,000
BART	75.4	2,400 /d/	--	--	17,700,000	181,000
AC Transit	22.7	3,200 /e/	--	492,000	--	72,600
CalTrain	11.8	3,000 /e/	--	239,000	--	35,300
SamTrans	3.35	3,200 /e/	--	72,500	--	10,700
Golden Gate Bus	14.0	3,200 /e/	--	304,000	--	44,800
Golden Gate Ferry	2.10	1,600 /e/	--	22,800	--	3,360
TOTAL			6,630,000	2,620,000	22,800,000	1,570,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on estimates of project-related passenger and vehicle trips, modal splits, and geographic distribution of trips developed in the transportation analysis. Miles shown are vehicle-miles for autos and passenger-miles for all other modes. Daily trips were multiplied by 295 "workday equivalents" per year to obtain annual trips.

/b/ Based on fuel efficiency projections and percent diesel estimates from Caltrans, 1983, Energy and Transportation Systems. Fuel consumption rates were converted from miles-per-gallon to Btu/mile using the projected mix of gasoline and diesel and their at-source energy contents (143,700 Btu/gallon for gasoline and 147,600 Btu/gallon for diesel). Year 2005 projections are the latest available projections and were used for the year 2020 consumption factor.

/c/ Based on the system-wide average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from MUNI, 1986, Urban Mass Transit Section 15 Reporting Requirements Year Ending June 30, 1986. Energy consumption was converted from diesel and electricity to Btu using at-source energy contents of 147,600 Btu/gallon and 10,239 Btu/kWh, respectively.

/d/ Based on average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from Bay Area Rapid Transit District, 1986, Quarterly Performance Report July-September 1986. Electrical consumption was converted to Btu using the at-source energy content of 10,239 Btu/kWh.

/e/ Based on average energy consumption per passenger-mile for various modes of transit as contained in Oak Ridge National Laboratory, 1985, Transportation Energy Data Book: Edition 8.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.H.18: ANNUAL TRANSPORTATION ENERGY CONSUMPTION, ALTERNATIVE N, BUILD-OUT/2020

Mode	Annual Miles Traveled (in millions)/a/	Energy Consumption Factor (Btu/Mile)	Annual Energy Consumption: Gasoline (Gals.)	Diesel (Gals.)	Electricity (kWh)	Btu (in millions)
Auto	316	4,200 /b/	7,880,000	1,340,000	--	1,330,000
MUNI	11.1	2,900 /c/	--	110,000	1,560,000	32,200
BART	44.6	2,400 /d/	--	--	10,500,000	107,000
AC Transit	17.3	3,200 /e/	--	375,000	--	55,300
CalTrain	4.43	3,000 /e/	--	90,100	--	13,300
SamTrans	2.96	3,200 /e/	--	64,100	--	9,460
Golden Gate Bus	10.6	3,200 /e/	--	230,000	--	33,900
Golden Gate Ferry	1.82	1,600 /e/	--	19,700	--	2,910
TOTAL			7,880,000	2,230,000	12,100,000	1,580,000

NOTE: Totals may not add due to rounding (entries rounded to three significant digits).

/a/ Based on estimates of project-related passenger and vehicle trips, modal splits, and geographic distribution of trips developed in the transportation analysis. Miles shown are vehicle-miles for autos and passenger-miles for all other modes. Daily trips were multiplied by 295 "workday equivalents" per year to obtain annual trips.

/b/ Based on fuel efficiency projections and percent diesel estimates from Caltrans, 1983, Energy and Transportation Systems. Fuel consumption rates were converted from miles-per-gallon to Btu/mile using the projected mix of gasoline and diesel and their at-source energy contents (143,700 Btu/gallon for gasoline and 147,600 Btu/gallon for diesel). Year 2005 projections are the latest available projections and were used for the year 2020 consumption factor.

/c/ Based on the system-wide average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from MUNI, 1986, Urban Mass Transit Section 15 Reporting Requirements Year Ending June 30, 1986. Energy consumption was converted from diesel and electricity to Btu using at-source energy contents of 147,600 Btu/gallon and 10,239 Btu/kWh, respectively.

/d/ Based on average energy consumption per passenger-mile for fiscal year 1985-1986, as derived from Bay Area Rapid Transit District, 1986, Quarterly Performance Report July-September 1986. Electrical consumption was converted to Btu using the at-source energy content of 10,239 Btu/kWh.

/e/ Based on average energy consumption per passenger-mile for various modes of transit as contained in Oak Ridge National Laboratory, 1985, Transportation Energy Data Book: Edition 8.

SOURCE: Environmental Science Associates, Inc.

APPENDIX I. GEOLOGY AND SEISMICITY

TABLE XIV.I.1: ACREAGE PROPOSED FOR BUILDING USES IN DIFFERENT SOIL ZONES

Expected Settlement	Building Use	Floors/a/	Alternative A	Alternative B	Alternative N
	Office	6-8	11.6	5.9	5.2
	S/LI/RD	2-4	40.5	6.0	--
	Retail	---	0.4	--	--
	M-2 Industrial	--	--	--	43.2
	Port-Related/M-2	2			
	HDR	6-8	1.0	--	--
<2 inches	MHDR	6-8	6.8	23.5	--
	MDR	3-6	10.7	33.9	--
	LDR	2-4	--	3.2	--
	CF	2-3	--	1.5	--
	Office	6-8	7.5	--	--
	S/LI/RD	2-4	8.5	--	--
	Retail		--	2.0	1.2
	Hotel	6-8	3.5	--	--
	M-2 Industrial	2	--	--	54.8
	Port-Related/M-2	2	--	--	27.6
	HDR	6-8	3.8	--	--
	MHDR	6-8	8.9	7.6	--
2-6 inches	MDR	4-6	28.3	25.4	--
	LDR	2-4	2.2	9.2	--
	CF	2-3	1.7	1.5	--
	Office	6-8	7.7	--	--
	S/LI/RD	2-4	1.2	--	--
	Retail		--	0.2	0.5
	M-2 Industrial	--	--	--	31.2
	Port-Related/M-2	2	6.5	--	20.0
	HDR	6-8	2.2	--	--
>6 inches	MHDR	6-8	5.1	10.0	--
	MDR	4-6	23.8	13.9	--
	LDR	2-4	4.2	6.5	--
	CF	2-3	0.7	2.6	0.8

/a/ The number floors is a range assumed for the discussion of settlement and foundation type.

SOURCE: Environmental Sciences Associates.

TABLE XIV.I.2: PREDICTIONS OF INJURY AND DEATH BASED ON STRUCTURAL DAMAGE FOR HEAVY CONSTRUCTION/a/•

% Damage	Fraction Injured Minor	Fraction Injured Serious	Fraction Dead
0%	0	0	0
0-1%	3/100,000	1/250,000	1/1,000,000
1-10%	3/10,000	1/25,000	1/100,000
10-30%	3/1,000	1/2,500	1/10,000
30-60%	3/100	1/250	1/1,000
60-100%	3/10	1/25	1/100
100%	2/5	2/5	1/5

/a/ Applied Technology Council, draft, 1985. ATC-13 -- Earthquake Damage Evaluation Data for California. Prepared by Christopher Rojahn and Roland L. Sharpe for the Federal Emergency Management Agency. Heavy construction is steel, masonry and concrete. Light construction is wood frame and light metal.

SOURCE: ABAG, "Building Stock and Earthquake Losses - The San Francisco Bay Area Example," May 1986.

APPENDIX J. HYDROLOGY AND WATER QUALITY

TABLE XIV.J.1: SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD OBJECTIVES FOR INLAND SURFACE WATERS

Constituent	Criteria
Color	Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses.
Taste and Odors	Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance or adversely affect beneficial uses.
Floating Material	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Settleable Material	Waters shall not contain substances in concentrations that result in the deposition of materials that cause nuisance or adversely affect beneficial uses.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or otherwise adversely affect beneficial uses.
Biostimulatory Substances	Water shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases shall not be greater than 10% in areas of 10 Jackson Turbidity Units (JTU) or more.

(continued)

TABLE XIV.J.1: SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD OBJECTIVES FOR INLAND SURFACE WATERS (continued) •

Constituent	Criteria
pH	Range shall be between 6.5 and 8.5. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.
Dissolved Oxygen	5.0 mg/l minimum
Bacteria (MPN/100 ml)	
Water Contact Recreation	Fecal Coliform - log mean <200, 90 percentile <400 Total Coliform - median <240, no sample >10,000
Non-Contact Water Recreation	Fecal Coliform - mean ≤2,000, 90 percentile ≤4,000
Temperature	Elevated temperature wastes shall comply with limitations necessary to assure protection of beneficial uses.
Toxicity	All waters shall be maintained free of toxic substances (pesticides, heavy metals, other substances) in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms.
Un-ionized Ammonia	The discharge of wastes shall not cause receiving waters to contain concentrations of un-ionized ammonia in excess of the following limits: 0.025 mg/l as N Annual Median 0.16 mg/l as N Maximum (Central Bay)
Sulfide	All waters shall be free from dissolved sulfide concentrations above natural background levels.

SOURCE: San Francisco Bay Regional Water Quality Control Board, Water Quality Control Plan, San Francisco Bay Basin, 1982, and Amendments, 1987.

RUNOFF CALCULATIONS

The peak runoff flows under existing and post-development conditions were calculated by use of the Rational Method. This method is often used in design of stormwater drainage systems and is suggested for estimating runoff in the City of San Francisco's Subdivision regulations./1/ The Rational Method uses the equation:

$$Q = CIA$$

in which:

- Q = Runoff in cubic feet per second (cfs)
- C = Coefficient of runoff
- I = Intensity of rainfall during the time of concentration in inches per hour (in/hr) which is approximately equal to cfs/acre.
- A = Area in acres.

The coefficient of runoff defines the proportion of rainfall that becomes runoff. Its value is based on the permeability of the land cover at a site as estimated from the predominant land use of the site. For this study, the intensity of rainfall used was 3.13 inches per hour, which is based on a five-year storm and a time of concentration of five minutes. These values are suggested in the City Subdivision regulations for generally flat sites such as the Project Area./1/

Runoff coefficients for existing conditions were determined by a thorough examination of the land use on the site including review of a 1985 aerial photograph and topographic map of the area and by a site visit. Several general land-use types for the assignment of runoff coefficients were identified and the amount of area in each type was measured from the topographic map. An applicable range of runoff coefficients was determined by use of the City Subdivision regulations or other references; the appropriate value within that range was selected based on local conditions./1,2/

The site includes 16.6 acres that do not appear to contribute to the sewer system; runoff generated in these areas evaporates, infiltrates into the soil or flows directly into the Bay. This estimate is based on information from the San Francisco Department of Public Works indicating that no sewers exist beneath China Basin Street, and from analysis of the topography of the site. This acreage also includes a small area adjacent to the China Basin Channel that appears to drain directly into the channel. The Channel Street Pump Station occupies 1.5 acres of the site which is not included in this analysis. Table XIV.J.1 summarizes the calculated runoff for the site.

NOTE: See notes at end of Appendix J. pp. XIV.J.15

TABLE XIV.J.2: RUNOFF CALCULATIONS -- EXISTING CONDITIONS

Predominant Surface	C /a/	North of Channel Area (acre)	North of Channel Runoff (cfs)	South of Channel Area (acre)	South of Channel Runoff (cfs)	Mariposa Area (acre)	Mariposa Runoff (cfs)
Industrial	0.9	0.0	0.0	94.18	192.49	29.11	55.76
Streets, Paved Lots	0.9	19.46	27.66	15.58	31.84	7.04	13.49
Freeway	0.9	13.54	19.25	1.56	3.19	10.24	19.62
Railroad	0.3	18.88	8.95	17.77	12.11	8.15	5.20
Gravel/Dirt	0.3	17.89	8.48	48.01	32.71	8.00	5.11
TOTAL		69.77	64.34	177.10	272.34	62.54	99.18

GRAND TOTAL Acreage: 309.41 Runoff: 435.86 cfs

cfs - cubic feet per second

/a/ Runoff coefficient.

SOURCE: Environmental Science Associates, Inc.

SOIL LOSS CALCULATIONS

The Universal Soil Loss Equation (USLE) has the general form:

$$A = R \times K \times LS \times C \times P$$

where:

A = soil loss, tons/(acre) (year)
R = rainfall erosion index
K = soil erodibility factor, tons/acre per unit of R
LS= slope length and steepness factor, dimensionless
C = vegetative cover factor, dimensionless
P = erosion control practice factor, dimensionless

Assumptions made to determine numerical values for each factor are as follows:

R. The rainfall erosion index for San Francisco can be approximated by the equation $R = 16.55p^{2.2}$ where p is the 2-year, 6-hour rainfall in inches./7/ According to depth-duration-frequency data for San Francisco, p = 1.3 inches./8/ Therefore,

$$R = 16.55\ (1.3)^{2.2} = 29.47$$

Rounding to an integral value; R = 29.

K. The soil erodibility factor for a soil which is half sand and half silt is about 0.50./7/ Therefore:

$$K = 0.50$$

LS. The slope length and steepness factor has different values for the pile of stored soil and the surcharge. In each case, the angle of repose for sand (30°) has been used to calculate steepness. The slope is 2:1 (horizontal:vertical) when the angle of repose is 30°. For a 20-foot storage pile, slope length would be 40 feet; for the surcharge, the slope length would be 10 feet. The two values for LS are then calculated./7/

$$\text{LS (storage pile)} = 11.27$$
$$\text{LS (surcharge)} = 5.64$$

C. The vegetative cover factors range from 1.0 for bare soil to 0.01 for undisturbed mature vegetation. Use of temporary seedings could reduce soil loss by up to 90%. Use of excelsior mat or jute could reduce losses by 70%./7/ In this case, bare soil is assumed. Therefore:

$$C = 1.0$$

P. The erosion control practice factor is a measure of the surface conditions. Values range from 0.8 to 1.3./7/

For the storage piles, it is assumed that the soil would be loose; i.e., not compacted or graded.

$$\text{P (storage)} = 0.8$$

For surcharges, it is assumed that the surface is smooth and compacted.

$$\text{P} = \text{(surcharge)} = 1.3$$

Calculations for both cases give:

$$\text{A (storage)} = (29)\ (0.50)\ (11)\ (1.0)\ (0.8) = 127.6 \text{ tons/acre-year}$$
$$= 130 \text{ tons/acre-year}$$

$$\text{A (surcharge)} = (29)\ (0.50)\ (5.6)\ (1.0)\ (1.3) = 105.6 \text{ tons/acre-year}$$
$$= 110 \text{ tons/acre-year}$$

COMBINED SEWER OVERFLOWS

Constituents found in combined sewer overflows include those found in sanitary sewage. Concentrations of most contaminants of concern are lower in the overflows because of dilution by stormwater. The following describes the general water quality characteristics at combined sewer overflows. This discussion is based on the CH_2M Hill 1979 study, Bayside Overflows, referenced below.

The coliform group of bacteria is found in soils and in the intestinal tract of warm-blooded animals. Total coliform values ranged from 10^3 to 10^8 most probable number (MPN)/100 milliliter (ml). Most total coliform values at the overflow structures were roughly 10^6 MPN/100 ml of water./4/

Fecal coliforms are a subset of coliform bacteria that are found only in the intestinal tract of warm-blooded animals and are an indicator of contamination by human or animal wastes. Fecal coliform comprised an average of about 40% of the total coliform population. This, too, was highly variable as the fecal coliform levels ranged from less than 1% to 100% of the total population. Generally, the coliform levels in combined sewage (as occurs in San Francisco) are an order of magnitude below the coliform levels in sanitary sewage./5/

The total suspended solids concentrations found in combined sewer overflows ranged from 8 to 1,440 milligrams per liter (mg/1). Average suspended solids levels were less than 100 mg/1 with 90% of the measurements less than 150 mg/1. A comparison was made between wet-weather and dry-weather suspended solids levels with data from 1977. CH_2M Hill reports the 1970 to 1976 average dry-weather influent suspended solids level as 280 mg/1 and the 1970 to 1976 average wet-weather level as 233 mg/1 in the influent to the Southeast Wastewater Treatment Plant./5/

Analysis of wet-weather wastewater character reveals an influent flushing effect during rain storms. It appeared that the suspended solids level first peaked sharply as inert solids were flushed from the sewers by the rainwater and then were diluted by the runoff. This flushing peak was generally not seen at the overflow structures during the first two storms assessed. Evidence of a suspended solids flushing peak was inconclusive because of the manner in which samples were composited.

The salinity of the combined wastewater overflows was calculated by converting the measured conductivity of the samples to salinity expressed in parts per thousand (ppt)./6/ The wet-weather influent to the Southeast Wastewater Treatment Plant had an average salinity of five ppt. In contrast, the samples taken from the overflow in the channel usually had salinities of less than one ppt. At times, the salinities of the overflow samples were higher, reaching from 18 to 25 ppt. This may have been caused by wave action flooding the sampler intake during the sampling period or from intruded salt water present in the sewers./5/

The salinity of the Bay varies according to the tides, but it is usually between 20 and 30 ppt. Because the salinity of the overflow is so much lower, it is less dense, and appears to float on the surface of the Bay for some time following an overflow. The salinity gradient between the waste field and the underlying Bay water serves as one method of tracing the extent of the combined wastewater overflow in the Bay./5/

Ammonia concentrations at various bayside overflow structures were highly variable with values between 0.3 and 5 mg/l. Typical concentrations in raw sewage are 15 to 25 mg/1./5/ Typical values in central San Francisco Bay have been reported as 0.1 to 0.5 mg/1.

IMPACTS OF OVERFLOWS ON WATER QUALITY

The discussion in this section is based primarily on the 1979 CH_2M Hill report, Bayside Overflows./5/ During overflows, coliform concentrations in the channel were 1,000 to 10,000 times above background levels, and concentrations in the offshore stations were about ten times above background. The coliform levels in the channel were diluted by about 10:1 by the end of the pier line. After the overflow stopped, the bacteria level decreased rapidly. About 90% of the bacteria disappeared after about 24 hours in the channels sampled; disappearance was faster in the open Bay. Within two days following an overflow, the coliform concentration in the offshore stations had returned to background levels. The five-day sampling periods were insufficient to determine compliance with bacteriological objectives./5/

Combined wastewater overflows had a measurable effect on salinity. During peak overflow periods, salinity gradients may be clearly defined where the wastewater flows into the Bay, with surface salinities approximately 1% of the underlying Bay water salinity. Each storm considered resulted in strong salinity stratification in nearshore areas within the upper three to six feet of water. Offshore, less well-defined salinity gradients were noted. Salinity gradients at inshore stations generally returned to normal within approximately 24 hours./5/

Temperature impacts due to overflows were found to be minor, with the temperature of the wastefield being determined largely by the temperature of the weather front causing the precipitation. Maximum differences in temperature between Bay water and wastefield were seen during periods of maximum salinity differences, but did not exceed three degrees Celsius in any of the storms analyzed. The temperature profiles returned to normal within approximately 24 hours./5/

Suspended solids concentrations were not directly related to the timing or volume of overflows. Levels fluctuated dramatically at inshore stations. Wind and tide generated turbulence that apparently dominated the dynamics of suspended solids during overflows./5/

Combined sewer overflows had a minimal impact on dissolved oxygen profiles for the majority of the areas and storms studied as part of the bayside overflows report. Dissolved oxygen concentrations in the wastefield were slightly different from that of underlying Bay water. Oxygen saturation levels were typically between 50% and 100%. At times the dissolved oxygen saturation levels of the wastefield differed 10% to 15% from the underlying Bay water, although this difference amounted to less than 2 mg/l. There was no indication that offshore dissolved oxygen saturation was affected by overflows. Values were typical of the Bay, ranging from 80 to 100% saturation./5/

The channel often has low oxygen content throughout the water column with lowest values at the southwest end (head) of the channel. These low values are not directly attributable to the overflows since wastefield dissolved oxygen values are often above those of the underlying water. Overflows may indirectly contribute to these low dissolved oxygen

levels through oxidation of previously settled material introduced by the overflows. Dissolved oxygen concentrations in the channel at the Third Street Bridge were normal suggesting that these low background dissolved oxygen levels persisted only at the innermost end of the channel./5/

Combined sewer overflows did not have a major impact on pH in the channel. That is, pH levels during overflows were similar to those when overflows were not occurring./5/

WATER QUALITY OBJECTIVES

Table XIV.J.1, p. XIV.J.1, summarizes applicable water quality objectives from the San Francisco Bay Basin Water Quality Control Plan.

1987 OVERFLOW DATA

Tables XIV.J.3 and XIV.J.4, p. XIV.J.10, present 1987 data from the overflow structures in China Basin Channel. The data were collected during storms on the dates indicated at the Fifth and Sixth Street overflow structures.

RECENT WATER QUALITY SAMPLING

Table XIV.J.5, P. XIV.J.11, summarizes recent water quality data in China Basin Channel. Samples were collected at the bulkhead on the northeast corner of the Third Street bridge (Station 1), near the overflow structure on the north side of the channel near Fifth Street (Station 2), and near the Seventh Street overflow structure (Station 3). Until recently, samples were also collected from the channel on the north side of Sixth Street (Station 4), but this station was discontinued in 1986.

SEDIMENT COMPOSITION

Table XIV.J.6, p. XIV.J.12, summarizes sediment composition and analyses in China Basin Channel. Table XIV.J.7, p. XIV.J.14, is a comparison of China Basin Channel sediments to other sediments in San Francisco Bay.

TABLE XIV.J.3: 1987 OVERFLOW DATA - CHINA BASIN CHANNEL

Date/Site	Settleable Solids (ml/hr) /a/	pH /a/	Grease & Oil (mg/l) /a/	Conductivity (Umhos) /a/	Ammonia Nitrogen (mg/l)/b/	Biochemical Oxygen Demand (mg/l)/b/	Total Suspended Solids (mg/l)/b/
1/28/87							
Sixth Street	5.2 (0.5-5.5)	6.7 (6.4-6.9)	11 (5-16)	2,237 (771-6,068)	0.59	29	66
2/02/87							
Fifth Street	0.2 (0.0-0.8)	6.6 (6.5-6.7)	13 (10-18)	1,324 (734-1,900)	6.05	38	67
2/12/87							
Fifth Street	/c/ (trace-1.5)	6.7 (6.7-6.7)	7 (5-11)	1,303 (800-1,581)	3.01	47	72
Sixth Street	/c/ (trace-1.0)	6.7 (6.7-6.7)	8 (5-12)	1,259 (752-1,530)	3.25	45	68
3/5/87							
Fifth Street	trace	6.8 (6.7-6.9)	17 (6-39)	2,801 (2,234-3,234)	4.08	37	53
Sixth Street	trace	6.9 (6.8-6.9)	19.3 (5-46)	13,524 (12,396-14,112)	1.55	25	97
3/14/87							
Fifth Street	trace	7.5 (7.4-7.5)	5 (<5-5)/d/	6,732 (5,762-8,232)	17.3	49	41

/a/ Values given are averages and, in parentheses, range taken over the time of the overflow up to four hours after overflow.
/b/ Values are composites for the overflow event.
/c/ Average not calculable, trace amounts recorded at two, three and four hours after overflow.

SOURCE: San Francisco Clean Water Program, Northshore Receiving Water Monitoring Report, 1987. Provided by J. Salerno and A. Navarret of the Southeast Water Pollution Control Plant.

TABLE XIV.J.4: METALS CONCENTRATION IN OVERFLOWS - 24-HOUR COMPOSITE SAMPLES/a/

Date/ Station	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Silver	Zinc	Mercury
1/23/87									
Fifth Street	0.0025	<0.0012	<u>0.0211</u>*	0.118	0.0624	0.0159	<u>0.112</u>*	0.379*	<0.00025
2/3/87									
Sixth Street	0.002	<0.0012	<u>0.0362</u>*	0.024	0.033	0.0081	0.015	0.134	<0.00025
3/5/87									
Fifth Street	0.0015	<0.0012	0.0052*	0.026	0.0213	<u>0.5096</u>*	0.014	0.154	0.00041
Sixth Street	<0.0009	0.0061	<0.0012	0.015	0.0086	0.0265	0.007	0.129	0.00038
3/12/87									
Fifth Street	0.0012	<0.0012	<0.0012	<0.012	0.0089	0.0087	0.010	0.081	0.00061

/a/ All values in parts per million. Underlined values exceed the daily maximum toxic material effluent limitations established by the RWQCB. Asterisk (*) indicates the value exceeds the 6-month median limit.

SOURCE: San Francisco Clean Water Program, <u>Northshore Receiving Water Monitoring Report</u>, 1987. Provided by J. Salerno and A. Navarret of the Southeast Water Pollution Control Plant.

TABLE XIV.J.5: RECENT WATER QUALITY DATA, 1985 - 1987

Parameter	Station/a/ 1	2	3	4
Dissolved Oxygen (mg/l)	7.2 (4.3-9.4)	7.3 (4.4-10.8)	6.2 (3.2-9.4)	6.9 (4.5-9.3)
Oxygen Saturation (mg/l)	82.2 (40-102)	83.2 (33-139)	69.6 (40-98)	79.5 (56-119)
Ammonia (mg/l)/b/	0.185 (.05-.96)	0.253 (.05-.22)	0.391 (.09-.712)	0.229 (.04-1.12)
TOTAL COLIFORM (Percent > 1,000 MPN/100 ml)				
Wet weather/c/	36	46	67	
Dry Weather/d/	2	12	23	
Overall	19	31	45	

MPN - most probable number

/a/ Station locations are described in text, above. These stations correspond to Clean Water Program Station Southeast-North Point-North Shore Shoreline Sampling Stations (1985-1986) 22, 23, 24 and 25, respectively. Station 4 was only sampled part of the time. Values given are averages with range in parentheses.

/b/ The RWQCB objective for ammonia (0.16 mg/l maximum) is not met by any of these samples.

/c/ Wet weather includes October 1985 through March 1986.

/d/ Dry weather includes July through September 1985 and April through June 1986.

SOURCE: Data collected by the Clean Water Program for the Southeast-North Point-North Shore Shoreline Sampling 1985-1987. Provided by J. Salerno and A. Navarret of the Southeast Water Pollution Control Plant.

SEDIMENT COMPOSITION

Table XIV.J.6 presents data on composition of the sediments in China Basin Channel based on 1979 data. Table XIV.J.7, p. XIV.J.14, compares China Basin Channel sediments to sediments from other nearby San Francisco Bay locations. There are no established standards for sediments.

TABLE XIV.J.6: SEDIMENT ANALYSIS IN THE CHINA BASIN CHANNEL - AVERAGE CONSTITUENT CONCENTRATIONS, 1979

	China Basin/a/	Near Third Street/a/	Near Fourth Street/a/	Near Channel End/a/
Metals	n=5	n=5	n=4	n=5
mg/kg dry weight				
Arsenic	4.6	5.0	7.1	5.3
Cadmium	2.1	4.0	5.0	8.6
Chromium	145	161	173	154
Copper	61	73	172	293
Lead	48	103	678	2,580
Mercury	0.36	0.45	2.0	2.5
Nickel	97	102	113	94
Silver	0.9	1.2	9.5	16
Zinc	137	192	485	1,255
Total Organic Carbon				
% dry weight	1.54	1.82	4.33	11.59
Oil & Grease				
mg/kg dry weight	1,485	2,040	9,275	36,000
Hydrocarbons				
%	63	61	75	68
Particle Size Distributions				
Sand % > 62 microns	12.7	3.1	5.0	59.2
Silt % 2-62 microns	50.8	51.1	44.0	23.4
Clay % < 2 microns	36.5	45.8	51.0	17.4
Total Sulfide/a/				
mg/kg wet weight	156	190	934	1,478
mg/kg wet weight	422	429	2,285	3,333

(continued)

TABLE XIV.J.6: SEDIMENT ANALYSIS IN THE CHINA BASIN CHANNEL - AVERAGE CONSTITUENT CONCENTRATIONS, 1979 (continued)

	China Basin/a/	Near Third Street/a/	Near Fourth Street/a/	Near Channel End/a/
Chlorinated Hydrocarbons				
ug/kg dry weight				
AROCHLOR	5.5	4.2	13	28.2
DIELDRIN	<1	<1	<1	<1
PP'DDE	<1	<1	1.3	<2
PP'DDD	<1	<1	4	64
PP'DDT	1.8	<1	11	73
OP'DDT	<1	<1	<1	<1
OP'DDD	<1	<1	<1	<1

/a/ n is the number of samples taken. The value applies for all substances except sulfides for which n=3, except at Fourth Street where n=2.

SOURCE: CH_2M Hill Engineers, Bayside Overflows, 1979.

TABLE XIV.J.7: COMPARISON OF CHINA BASIN CHANNEL SEDIMENT ANALYSIS WITH RECENT DATA FROM OTHER SAN FRANCISCO BAY AREAS

INORGANICS (mg/kg dry wt.)	China Basin Channel/a/	S.F. Pier 94/96 Area/b/	Central Bay Reference/b/	Islais Creek/c/	Alcatraz Disposal Site Area/d/	Dry Dock-4 Hunters Point/e/	Hunters Point/f/
	n=5	n=9	n=1	n=3	n=11	n=3	n=3
Antimony	--	<0.5	<0.5	<50	--	87-102	1.6-3.1
Arsenic	4.6-7.1	<0.1	<0.1	57-72	0.4-1.2	12-13	7.8-8.8
Cadmium	2.1-8.6	0.1-0.2	0.2	<1-1	0.5-1.0	1.5-1.7	2.3-2.5
Chromium (total)	145-173	8.9-13.6	5	110-146	40-74	--	<0.1/h/
Copper	61-293	5.4-15.5	6,4	68-130	4-26	40-43	62-75
Lead	48-2,580	5.3-16	7.3	49-223	10-45	14-23	43-64
Mercury	0.36-2.5	<0.1-0.2	0.1	0.57-1.2	0.01-0.62	0.33-0.43	0.37-0.42
Nickel	94-113	15.3-22.7	9.4	88-96	26-50	86-91	120-130
Selenium	--	<0.1	<0.1	<3	<0.05-0.14	<0.05-0.09	0.3-0.4
Silver	0.9-16	0.17-0.36	0.24	4.0-8.6	0.40-0.87	1.1-1.6	1.7-2.1
Thallium	--	10.0-18.9	4.9	<2	--	11-18	22-24
Zinc	137-1,255	10.6-28	20.3	156-321	19-58	117-127	150-170
ORGANICS (ug/kg dry wt.)		n=9	n=1	n=3	n=11	n=3	n=3
4,4'-DDD	<1-64	<14-<140	<140	0.98-1.44	<1-6	1-2	1.1-1.8
4,4'-DDE	<1-1.3	<2-<20	<20	0.46-1.32	<0.5-3.4	1	1.7-2.6
4,4'-DDT	<1-73	<17-<170	<170	0.4-0.87	<1	1	<0.5
PCBs (total)	4.2-28.2/g/	<50-<500	<500	57.3-255.3	<20	--	<10
Acetone	--	--	--	--	--	20	50-120
Anthracene	--	<20-69	145	289-1,341	<66-390	<66	<20
Fluoranthene	--	<20-181	398	871-3,712	<66-630	87-150	20-65
Phenanthrene	--	<20-240	359	301-615	<66-1,100	<66-80	20-36
Pyrene	--	<20-390	839	1,292-2,666	<66-1,000	84-140	27-81
Benzo(a) Anthracene	--	<20-631	112	421-1,199	<66-370	<66	<20-26
Chrysene	--	<20	299	702-2,208	<66-430	<66	<20-31
Benzo(b) Fluoranthene	--	<20-649	456	--	<66-220	<66	<20-32
Benzo(k) Fluoranthene	--	<20-79	171	--	<66-200	<66-87	<20-30
Benzo(a) Pyrene	--	<20-191	512	365-820	<66-380	<66-130	20-46
Indeno(1,2,3-c,d) Pyrene	--	<20-250	294	--	<66-190	<66	<20-24
Benzo(g,h,i) Perylene	--	<20	<20	--	<66-250	<66-74	<20-35
Tributyltin	--	<2	<2	--	--	<1	<4
Monobutyltin	--	<2	<2	--	--	--	<4
Dibutyltin	--	<2	<2	--	--	--	<4

-- Not measured. n - number of samples taken.
/a/ Source: CH_2M Hill Engineers, 1979, Bayside Overflows. Table XIV.J.6 presents other measured parameters for China Basin Channel.
/b/ Source: Bendix Environmental Research Inc., May 7, 1987, Port of San Francisco Pier 94/96 Sediment Study.
/c/ Source: Chapman, et al., March 1986, "A Field Trial of the Sediment Quality Triad in San Francisco Bay," NOAA Technical Memorandum NOS OMA 25.
/d/ Source: U.S. Army Corps of Engineers, San Francisco District, April 14, 1987, Data reports from Toxscan, Inc. for 11 stations. Wet weight basis.
/e/ Source: Marine Bioassay Laboratories and Environmental Science Associates, Inc., February 1987, "Chemical and Bioassay Studies in Support of Maintenance Dredging Permit Application #16685548: Dry Dock Four, Hunters Point Naval Shipyard."
/f/ Source: Environmental Science Associates, Inc., June 1987, EIS: Homeporting Battleship Battlegroup/Cruiser Destroyer Group, Volume III, Verification Testing of Dredge Sediments.
/g/ Reported as AROCHLOR.

SOURCE: Environmental Science Associates, Inc.

NOTES - Hydrology and Water Quality

/1/ San Francisco Department of Public Works, Bureau of Engineering, Subdivision Regulation, adopted by Department of Public Works Order No. 124,677, January 6, 1987.

/2/ J.M. dela Cruz, Division Engineer, Civil Division, San Francisco Clean Water Program, telephone conversation, April 24, 1987. A record of this conversation is available at the Office of Environmental Review, Department of City Planning, 450 McAllister Street, San Francisco.

/3/ Kibler, David F., ed., Urban Stormwater Hydrology, Water Resources Monograph 7, American Geophysical Union, Washington, D.C., 1982.

/4/ MPN (Most Probable Number) is the number of coliform organisms likely to be present in a given water sample, based on statistical analysis of the results of a multiple-tube fermentation test.

/5/ CH_2M Hill Engineers, Bayside Overflows, report for the City and County of San Francisco, 1979.

/6/ Conductivity of water is the ability of the water to conduct an electrical charge. The conductivity of water is high with increasing salinity, and so is a measure of salinity.

/7/ Goldman, Steven J., Katherine Jackson, and Taras A. Bursztynsky, Erosion and Sediment Control Handbook, McGraw-Hill, New York, 1986.

/8/ Rantz, S.E., Mean Annual Precipitation and Precipitation - Duration - Frequency Data for the San Francisco Bay Region, California. U.S. Geological Survey Open-File Report, prepared in cooperation with the U.S. Department of Housing and Urban Development. San Francisco Bay Region Environment and Resources Planning Study, Basic Data Contribution 32, 1971.

APPENDIX K. VEGETATION AND WILDLIFE

TABLE XIV.K.1: TYPICAL BIRDS OF THE SAN FRANCISCO BAY WATERFRONT/a/•

Common Name	Scientific Name	High Count/b/
Grebes, Loons		
Western grebe/c/	Aechmophorus occidentalis	26
Clark's grebe/c,d/	Aechmophorus clarkii	1
Horned grebe/d/	Podiceps auritus	4
Eared grebe	Podiceps nigricollis	2
Pied-billed grebe/c,d/	Podilyumbus podiceps	
Red-throated loon/c,d/	Gavia stellata	1
Common loon/c,d/	Gavia immer	2
Cormorants and Pelicans		
Brown pelican/d/	Pelecanus occidentalis	21
Double-crested cormorant/c,d/	Phalacrocorax auritus	36
Brandt's cormorant/d/	Phalacrocorax penicillatus	6
Pelagic cormorant/d/	Phalacrocorax pelagicus	2
Herons		
Great blue heron/c,d/	Ardea herodias	2
Great egret/c,d/	Casmerodius albus	3
Snowy egret/d/	Egretta thula	2
Black-crowned night heron/c,d/	Nycticorax nycticorax	17
Green-backed heron/e/	Butorides virescens	NA
Waterfowl		
Mallard/c/	Anas platyrhynchos	
Northern pintail	Anas acuta	
Cinnamon teal	Anas cyanoptera	
American wigeon	Anas americana	
Northern shoveler	Anas clypeata	
Canvasback	Aythya valisineria	
Greater scaup/d/	Aythya marila	50
Lesser scaup/d/	Aythya affinis	7
Ruddy duck/d/	Oxyura jamaicensis	1
American coot/c/	Fulica americana	
Surf scoter/c,d/	Melanitta perspicillata	1,240
Bufflehead/d/	Bucephala albeola	3
Common goldeneye/d/	Bucephala clangula	10
Barrow's goldeneye/d/	Bucephala islandica	6

(continued)

TABLE XIV.K.1: TYPICAL BIRDS OF SAN FRANCSICO BAY WATERFRONT (continued)•

Common Name	Scientific Name	High Count/b/
Shorebirds		
Killdeer/c,d/	Charadrius vociferus	3
Black-bellied plover/d/	Pluvialis squatarola	1
Long-billed curlew	Numenius americanus	
Willet	Catoptrophorus semipalmatus	
Greater yellowlegs	Tringa melanoleuca	
Least sandpiper/d/	Calidris minutilla	23
Dunlin	Calidris alpina	
Short-billed dowitcher	Limnodromus griseus	
Spotted sandpiper/d/		2
Sanderling/d/		150
Western sandpiper	Calidris mauri	
Marbled godwit	Limosa fedoa	
American avocet	Recurvirostra americana	
Black-necked stilt	Himantopus mexicanus	
Gulls and Terns		
Glaucous-winged gull/c,d/	Larus glaucescens	825
Herring gull/d/	Larus argentatus	2
California gull/c,d/	Larus californicus	10
Ring-billed gull/c,d/	Larus delawarensis	4
Bonaparte's gull/c,d/	Larus philadelphia	1
Heermann's gull/c,d/	Larus heermanni	3
Western gull/c,d/	Larus occidentalis	565
Mew gull/c,d/	Larus canus	1,375
Thayer's gull/d/	Larus thayer	3
Forster's tern/d/	Sterna forsteri	2
Caspian tern/e/	Sterna caspia	NA
Kingfishers		
Belted kingfisher/c,d/	Ceryle alcyon	3
Raptors		
American kestrel	Falco sparverius	
Songbirds		
House sparrow/c,d/	Passer domesticus	35
House finch/c,d/	Carpodacus mexicanus	17
Song sparrow	Melospiza melodia	
European starling/c,d/	Sturnus vulgaris	370
Northern mockingbird/c,d/	Mimus polyglottos	1
Brewer's blackbird/c,d/	Euphagus cyanocephalus	2
Black phoebe/d/	Sayornis nigricans	1

(continued)

TABLE XIV.K.1: TYPICAL BIRDS OF SAN FRANCSICO BAY WATERFRONT (continued)

Common Name	Scientific Name	High Count/b/
Songbirds (continued)		
American crow/d/	Corvus brachyrhynchds	1
Common raven/d/	Corvus coray	1
Yellow rumped warbler/d/	Dendroica coronata	5
Palm warbler/d/	Dendroica palmarum	2
White crowned sparrow/d/	Zonotrichia leucophrys	4
Golden crowned sparrow/d/	Zonotrichia atricapilla	1
Western meadowlark/d/	Sturnella neglecta	2
Pine siskin/d/	Carduelis pinus	1
American goldfinch/d/	Carduelis tristis	1
Barn swallow/e/	Hirundo rustica	NA
Red-winged blackbird/e/	Agelaius phoeniceus	NA
Anna's hummingbird/e/	Calypte anna	NA
American robin/e/	Turdus migratorius	NA
Doves, pigeons		
Rock dove (city pigeon)/c,d/	Columba livia	57
Mourning dove/c,d/	Zenaida macroura	5

NA - Not available.

/a/ Unless otherwise noted, data from CH_2M Hill Engineers, 1983, Mission Bay Project EIR, prepared for Jefferson Associates.
/b/ Highest count observed during Audubon counts.
/c/ Observed during on-site bird censuses conducted by Environmental Science Associates on February 18 and 26 and March 14, 1986.
/d/ Observed during Audubon bird counts, conducted by Alan Hopkins, September 1987 to February 1988.
/e/ Observed by Alan Hopkins subsequent to his census conducted for the Mission Creek Conservancy.

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.K.2: BENTHIC INVERTEBRATE SPECIES IN CHINA BASIN CHANNEL/a/

Species	Mean Number per 0.05 m^2
Macoma spp. (juv.)	2.81
Oligochaeta	1.99
Macoma nasuta	1.53
Tharyx cf. monilaris	1.40
Glycinde sp.	1.09
Unidentified Cirratulidae	0.77
Leitoscoloplos pugettensis	0.66
Nephtys cornuta franciscana	0.47
Heteromastus filobranchus	0.47
Tharyx sp.	0.33

/a/ Ranked abundance of the 10 most abundant species found during five sampling periods between February and April 1979, at three monitoring stations at the head, mid-section and mouth of the China Basin Channel.

SOURCE: CH_2M Hill Engineers, Bayside Overflows, 1979, pp. VI-39.

TABLE XIV.K.3: CHINA BASIN CHANNEL FISH TRAWL SAMPLING

Species	China Basin Channel			
	Inner		Outer	
	Number	Weight (grams)	Number	Weight (grams)
English sole			63	637.1
Pacific herring	1	4.7		
Shiner surfperch	5	75.7	53	683.5
Northern anchovy	2	5.0	5	23.6
Speckled sanddab	1	6.8	26	62.5
Night smelt	--	--	1	2.2
Staghorn sculpin	--	--	2	15.2
Bay goby	--	--	6	18.5
Plainfin midshipman	--	--	1	154.3
Pacific tomcod	--	--	3	44.6
California halibut	--	--	1	144.0
Pipefish	--	--	1	1.6
Yellowfin goby	--	--	1	--
TOTAL (number/weight)	9	92.2	163	1,787.1
Total No. of Species	4	--	12	--
No. of Trawls	1	--	1	--
Trawl Time (minutes)	5	--	5	--
Catch/Minute	1.8	18.4	32.6	357.4

SOURCE: CH_2M Hill Engineers, Bayside Overflows, 1979, p. VI-39.

TABLE XIV.K.4: COMMON MARINE, SPORT AND COMMERCIAL FISHES OF SAN FRANCISCO BAY

Common Name	Scientific Name	Use
Sharks, Skates and Rays		
Sixgill cowshark	Hexanchus griseus	--
Sevengill cowshark	Notorynchus maculatus	--
Brown smoothhound	Mustelus henlei	--
Leopard shark	Triakis semifasciata	--
Soupfin shark	Galeorhinus zyopterus	--
Spiny dogfish	Squalus acanthias	--
California skate	Raja inornata	Commercial
Big skate	Raja binoculata	Commercial
Bat ray	Myliobatis californica	--
Schooling Pelagic, Bait and Forage Fishes		
Pacific sardine	Sardinops caeruleus	Commercial
Pacific herring/a/	Clupea harengus pallasii	Commerical
Ocean northern anchovy	Engraulis mordax mordax	Commerical
Bay northern anchovy/a,b/	Engraulis mordax nanus	--
Surf smelt	Hypomesus pretiosus	Comm., sport
Whitebait smelt	Allosmerus elongatus	--
Night smelt/b/	Spirinchus starksi	Commercial
Jacksmelt	Atherinopsis californiensis	Commercial
Topsmelt	Atherinops affinis	Commercial
Flatfishes		
English sole/b/	Parophrys vetulus	Commercial
Petrale sole	Eopsetta jordani	Commercial
Dover sole	Microstomus pacificus	Commercial
Rex sole	Glyptocephalus zachirus	Commerical
Pacific sanddab	Citharichthys sordidus	Commercial
Speckled sanddab	Citharichthys stigmaeus	Comm., sport
Starry flounder	Platicthys stellatus	Comm., sport
Diamond turbot	Hypsopsetta guttulata	Commercial
Curlfin turbot	Pleuronichthys decurrens	Commercial
Pacific halibut	Hippoglossus stenolepis	Commercial
Arrowtooth halibut	Atheresthes stomias	Commercial
California halibut/b/	Paralichthys californicus	--
Bottom Fishes		
Pacific tomcod/b/	Microgadus proximus	--
Staghorn sculpin/b/	Leptocottus armatus	--

(continued)

TABLE XIV.K.4: COMMON MARINE, SPORT AND COMMERCIAL FISHES OF SAN FRANCISCO BAY (continued)

Common Name	Scientific Name	Use
Bottom Fishes (continued)		
Bay goby/b/	Lepidogobius lepidus	--
Pipefish/b/	Syngnathus sp.	--
Saltwater Perch		
Walleye surfperch	Hyperprosopon argenteum	Comm., sport
White seaperch	Phanerodon furcatus	Commercial
Rubberlip perch	Rhacochilus toxotes	Comm., sport
Pile perch	Rhacochilus vacca	Comm., sport
Black perch	Embiotoca jacksoni	Sport
Striped seaperch	Embiotoca lateralis	Sport
Calico surfperch	Amphistichus koelzi	Comm., sport
Barred surfperch	Amphistichus argenteus	Sport
Redtail surfperch	Amphistichus rhodoterus	Comm., sport
Silver surfperch	Hyperprosopon ellipticum	Comm., sport
Rainbow seaperch	Hypsurus caryi	Comm., sport
Shiner perch/a,b/	Cymatogaster aggregata	Comm., sport
Anadromous Fish		
Striped Bass	Morone saxatilis	Sport
Chinook Salmon	Oncorhynchus tshawytscha	Comm., sport

/a/ Collected in Mission Creek west of Fourth Street Bridge by otter trawl (CH_2M Hill, 1979).

/b/ Collected in Mission Creek east of Third Street Bridge by otter trawl (CH_2M Hill, 1979).

SOURCE: CH_2M Hill Engineers, 1983, modified by Environmental Science Associates.

SAN FRANCISCO BAY PLAN

In the San Francisco Bay Plan, BCDC has developed policies concerning fish and wildlife in San Francisco Bay. Those policies state:

1. The benefits of fish and wildlife in the Bay should be insured for present and future generations of Californians. Therefore, to the greatest extent feasible, the remaining marshes and mudflats around the Bay, the remaining water volume and surface area of the Bay, and adequate fresh water inflow into the Bay should be maintained.

2. Specific habitats that are needed to prevent the extinction of any species, or to maintain or increase any species that would provide substantial public benefits, should be protected, whether in the Bay or on the shoreline behind dikes. Such areas on the shoreline are designated as Wildlife Areas on the Plan maps./1/

Additional BCDC policies addressing marshes and mudflats in San Francisco Bay state:

1. Marshes and mudflats should be maintained to the fullest possible extent to conserve fish and wildlife and to abate air and water pollution. Filling and diking that eliminate marshes and mudflats should therefore be allowed only if there is no reasonable alternative. Marshes and mudflats are an integral part of the Bay tidal system and therefore should be protected in the same manner as open water areas.

2. Any proposed fills, dikes or piers should be thoroughly evaluated to determine their effects on marshes and mudflats, and then modified as necessary to minimize any harmful effects.

3. To offset possible additional losses of marshes due to necessary filling and to augment the present marshes, (a) former marshes should be restored when possible through removal of existing dikes, (b) in areas selected on the basis of competent ecological study, some new marshes should be created through carefully placed lifts of dredged spoils, and (c) the quality of existing marshes should be improved by appropriate measures whenever possible./1/

NOTES - Vegetation and Wildlife

/1/ San Francisco Bay Conservation and Development Commission, San Francisco Bay Plan, 1979.

APPENDIX L: HAZARDOUS WASTES

HAZARDOUS WASTE REGULATION

The federal (1976) and state (1972) governments recognized in the 1970's that special regulatory attention to hazardous materials and hazardous wastes was needed to protect public health. Numerous instances of the discovery of hazardous waste contamination of soils, water and groundwater in the past decade have resulted in a proliferation of federal and state regulations, and the extension of intensive regulatory involvement at the local agency level. The following section discusses federal, state, and local laws and regulations with which Mission Bay may need to comply.

FEDERAL ACTS

Comprehensive Environmental Response, Compensation, and Liability Act (1980) (CERCLA or "Superfund"), was enacted to ensure that victims of a release are compensated for injuries, that environmental damages are corrected, to ensure adequate emergency response and to begin clean-up of hazardous substance releases.

CERCLA contains four major components to achieve the stated purpose and intent. These components are: mandatory reporting of hazardous substance releases of "reportable quantities;" establishment of a National Contingency Plan (NCP) and response authority; creation of funds to finance remedial authority to compensate victims; and creation of rules of liability which favor compensation. CERCLA establishes a Hazardous Substance Response Trust Fund, the Emergency Response Trust Fund and the Post-Closure Liability Trust Fund.

The Hazardous Response Trust Fund ensure that funds are available to pay for response to and clean-up of hazardous substance releases. Monies are obtained through excise tax on petroleum products, taxes on certain chemicals, monies from civil penalities collected under the Federal Water Pollution Control Act, and penalties assessed under CERCLA. The Emergency Response Trust Fund is financed by direct appropriations by Congress. The Post-Closure Liability Trust Fund assists in clean-up of releases which occur after owners or operators have properly decommissioned hazardous waste facilities in conformance with Subtitle C of the Solid Waste Disposal Act.

CERCLA mandates that a person or firm who has owned or operated or who owns or operates a facility at which hazardous substances of a reportable quality have been discharged to report the incident to the Environmental Protection Agency (EPA). Potential CERCLA sites may also come to the attention of the EPA through other permitting processes and citizen complaints. Once a potential site comes to the attention of the EPA, a site characterization study is performed by the EPA or their authorized subcontractor. Sites are evaluated for CERCLA clean-up on the basis of EPA's Hazard Ranking System; a score of 28.5 or greater gets the site placed on the National Priority List (NPL) for clean-up. Clean-up levels are determined based on information obtained during the site characterization study and include such factors as extent of contamination, type of contamination, topography, geology, surface and groundwater hydrology, climatology, potential affected population and the economic feasibility of various levels of clean-up.

The Superfund Amendments and Reauthorization Act of 1986 (SARA), was enacted on October 17, 1986. The new Superfund reauthorizes the program for five years. SARA strengthens and expands the clean-up program, increased the Fund to $8.5 billion and changes the tax structure for financing the Fund. In addtion, SARA focuses on the need for emergency preparedness and community right-to-know.

The EPA has the primary responsibility for managing clean-up and enforcement activities under Superfund. States have always been encouraged to participate in the Superfund process. Now, states are more formally involved in the selection, initiation, and development of remedial responses. Either EPA or the state may take the lead role in managing clean-up activities. When EPA is the lead agency, the U.S. Army Corps of Engineers manages the remediation for EPA.

Superfund is fundamentally action-oriented. Before Superfund, the federal government lacked the authority to respond to releases of hazardous substances or to clean up hazardous waste sites. Under Superfund the EPA determines the necessary responses for removal actions and remedial actions. Removal actions are short-term actions which stabilize or clean-up a hazardous site that poses a threat to human health. Removal actions can include removal of tanks or drums, installation of fencing or providing drinking water. Remedial actions are generally longer-term and usually more expensive actions with the goal being a permanent remedy.

EPA encourages community involvement in determining the best way to clean up Superfund sites. To ensure two-way communications from the outset at each remedial action site, a community relations program is designed to meet local circumstances.

SARA strongly encourages the use of alternative technologies to reduce the toxicity, mobility, or volume of hazardous wastes.

<u>Toxic Substances Control Act (1976) (TSCA)</u>, was enacted to prevent the environment from becoming a laboratory from which harmful effects of chemicals are discovered. TSCA designates the EPA as the agency with two powers to achieve this end. First, EPA must develop data which assesses the effects of chemical substances on the health and human environment. EPA places the burden of ensuring adequate research and testing of toxic substances on companies who seek to profit from the manufacture, use and sale of such items. Second, EPA is vested with the authority to regulate the manufacture, distribution in commerce, processing, use or disposal of chemical substances which may present an unreasonable risk of injury to human health or the environment.

Chemical substances under TSCA enjoy a broad definition which includes organic or inorganic compounds, and particular substances or multiple combinations, resulting as a chemical reaction. Preempted from TSCA regulations (but regulated under other federal laws) include pesticides, nuclear material and food additives.

TSCA is limited to "commercial activity" which is defined as profit activities and research activities leading to a profit. Once EPA determines that the testing of a particular chemical is necessary, they mandate the particular business to conduct such tests. TSCA is intended to be used as a last resort, however, while other environmental laws come to the forefront.

<u>Resource Conservation and Recovery Act of 1976 as Amended by the Hazardous Solid Waste Act of 1984 (RCRA)</u>, a prescriptive statute, created a major new federal hazardous waste regulatory program, prohibits open dumping, and establishes 1990 as the date that EPA must promulgate land disposal restrictions for all hazardous wastes. RCRA establishes definitions of hazardous wastes, and requirements for transportation, treatment, storage, and disposal of those materials. RCRA is implemented by Code of Federal Regulations Title 40 (40 CFR) Parts 260-271. Of particular importance to Mission Bay are Parts 261 and 262 which include the "Identification and Listing of Hazardous Wastes" (Part 261) and "Standards Applicable to Generators of Hazardous Wastes" (Part 262).

An important element of RCRA is the manifest process (40 CFR) Part 262, Subpart B. That process requires a generator to determine if a particular waste is hazardous, and to prepare a manifest for transport for off-site treatment, disposal or storage. This process facilitates tracking the waste from the site through the treatment and disposal process, or, as it is commonly referred to, regulates the hazardous waste stream from the "cradle to the grave." As soon as an individual or firm becomes aware of hazardous wastes on its property, it comes under the provisions of RCRA through the treatment, storage and/or disposal framework.

RCRA site clean-up is conducted to levels specified in 40 CFR, Part 264, differing from CERCLA which is based on a site characterization study. However, EPA is in the process of revising clean-up standards under its corrective action authority; the standards are expected to be more stringent. EPA makes the final determination if a site must comply with RCRA or CERCLA; a site could come under both provisions. It is likely, however, that Mission Bay would come under the provisions of RCRA.

The Hazardous Solid Waste Act (HSWA) of 1984, which in part amends RCRA, places specific prohibitions on the disposal of certain hazardous wastes by particular techniques. An immediate ban was levied on placing hazardous wastes in salt formations, salt bed formations, underground mines and caves. Land disposal of some liquid hazardous wastes known as the "California List" (see Table XIV.L.1) and dioxins and halogenated wastes also was prohibited. The HSWA establishes a schedule for EPA to examine all listed hazardous wastes and promulgate land disposal restrictions. HSWA also encourages development, testing, and certification by EPA of new treatment and disposal technologies of hazardous wastes.

The 1984 HSWA also includes regulations for underground storage tanks (USTs) used to store hazardous materials and petroleum products. Owners and operators of USTs were and are required to notify EPA of existing and new USTs. Federal regulations to govern USTs still are being developed. Excluded from regulation are farm or residential tanks of 1,100 gallons or less storing motor oil for non-commercial purposes; heating oil tanks storing fuel for consumption on premises; septic tanks; pipelines regulated under the Natural Gas Pipeline Safety Act of 1968, the Hazardous Liquid Pipeline Safety Act, or that which is an intrastate pipeline facility regulated under laws comparable to the Gas and Liquid Pipeline Acts; surface impoundments, pits, ponds or lagoons; storm water or wastewater collection systems; flow-through process tanks; liquid trap or gathering lines directly related to oil or gas production; and storage tanks situated on or above a floor in an underground area.

RCRA also mandated a state-by-state tank inventory and data base to be developed by the governors of individual states by May 1985. California, however, had enacted similar legislation, Assembly Bill 2013, Cortese (1983) prior to the RCRA mandate. That legislation designated the State Water Resources Control Board (SWRCB) as the state agency responsible for compiling a UST inventory. Individual tank owners were to notify the SWRCB by July 1, 1984 of known in-use and abandoned tanks. Owners of new USTs must notify the SWRCB within 30 days of installation. Permitting of USTs are handled through local governmental agencies. The San Francisco Department of Public Health Environmental Health Division is the local agency designated to permit, inspect, and implement UST regulations.

RCRA provides for individual state development, regulation and implementation of hazardous wastes programs which have the same force as RCRA itself. RCRA requires that state programs be as stringent as federal statutes and regulations. EPA must approve such a state program (if it is intended to implement federal regulations) and also retains federal oversight. California has developed such a program known as the

TABLE XIV.L.1: "CALIFORNIA LIST" OF LIQUID HAZARDOUS WASTES/a/

Substance	Amount
Arsenic/b/	500 mg/1
Cadmium/b/	100 mg/1
Chromium (VI)/b,c/	500 mg/1
Cyanides (free)	1,000 mg/1
Lead/b/	500 mg/1
Mercury/b/	20 mg/1
Nickel/b/	134 mg/1
pH/d/	2 or below
Polychlorinated Biphenyls (PCBs)	500 ppm
Halogenated Organic Compounds/e/	1,000 mg/kg

/a/ Liquid hazardous wastes containing an identified substance in milligrams per liter, except where specified.
/b/ Includes the elements themselves or compounds containing those elements.
/c/ Chromium may exist in two species that are of concern as a hazardous waste, chromium (III) or chromium (VI). The latter is much more toxic.
/d/ pH is a measure of acidity or alkalinity. The lower the pH, the more acidic the solution is.
/e/ Item refers to solids in solution in milligrams per kilogram.

SOURCE: Environmental Science Associates, Inc., California Health and Safety Code Section 25122.7 and United States Code, Title 42, Section 6924(d)(e).

California Hazardous Waste Law. See the section entitled "State Laws" following this section for a discussion of state hazardous waste law and implementation procedures.

The Federal Water Pollution Control Act of 1970 (Clean Water Act), also referred to as the Clean Water Act, establishes a national policy to eliminate discharge of pollutants into navigable waters and prohibit the discharge of hazardous pollutants. The National Pollutant Discharge Elimination System (NPDES) established under the Clean Water Act requires a person or firm to obtain a permit prior to discharging a pollutant into the waters of the United States from a point source. An NPDES permit may be obtained by application to the EPA or to a state having a certified Clean Water Act program, such as California. California administers that program through the State Water Resources Control Board and the appropriate Regional Water Quality Control Boards. Ocean discharge is not permitted unless the discharge complies with established guidelines set forth in United States Code, Title 3.3 Section 1343 and 40 CFR, Parts 221-224. A permit must be obtained from the Secretary of the Army through the Chief of Engineers (Army Corp of Engineers) prior to discharge of dredge and fill materials into navigable waters at specified disposal sites.

A project would have to apply, and meet specific criteria if the option of ocean disposal of wastes is considered. If contaminant levels in materials to be disposed were too high, then ocean disposal would not be possible.

The Federal Clean Air Act of 1970 (CAA) was enacted to "protect and enhance" the quality of the nation's air, and provide scientific understanding and the technological ability to establish effective air pollution control programs. Pursuant to The Federal Clean Air Act, EPA established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The Act was amended in 1977 to require individual states where NAAQS were being exceeded to develop and adopt air quality plans that identified strategies to achieve the NAAQS by 1987. States such as California also adopted air quality standards for criteria air pollutants that are more stringent than the NAAQS. Air quality on the local and regional level is monitored by Air Quality Management Districts and Air Pollution Control Districts, such as the Bay Area Air Quality Management District (BAAQMD).

Of particular importance to the Mission Bay project is the National Emission Standards for Hazardous Air Pollutants (NESHAPS) Program established by the Federal Clean Air Act and enforced in San Francisco by BAAQMD. NESHAPS regulate emissions of the following hazardous substances: beryllium, mercury, friable asbestos, vinyl chloride and benzene. A permit must be secured from the BAAQMD before treating or disposing of such substances, such disposal or treatment methods include any technology that could cause these substances to become airborne. Additionally, disposal of these hazardous substances would also come under the regulatory framework of RCRA and California's toxic laws and hence involve the permitting process through the State Department of Health Services with EPA oversight.

STATE LAWS

California Hazardous Waste Control Law of 1972 (HWCL) empowers the California State Department of Health Services (DOHS) to manage the hazardous waste stream by regulating those who generate, transport, and dispose of such material. The HWCL differs from RCRA in that: HWCL makes it clear that generators of hazardous waste have the primary duty for safe disposal (Health and Safety Code Sections 25100(a), 2510(a)); and puts greater emphasis on recycling of hazardous waste to reduce the need for land disposal. Regulations tend to be more stringent under HWCL and related California statutes in areas of transportation, identification of hazardous wastes and land disposal. A generator is defined as a person whose act or process on a particular site produces a hazardous waste or whose act first cause a hazardous waste to become subject to regulation under HWCL or Title 22, Division 4, Chapter 30 of the California Administrative Code Section 66078. A generator is obligated to determine if a waste is hazardous. This includes determining if a listed hazardous wastes is present as well as evaluating the waste in terms of the physiochemical criteria contained in 22 CAC Section 66680. The chemical analysis of a given waste must be performed by a laboratory certified by DOHS or EPA.

A generator of a waste must prepare a Uniform Hazardous Waste Manifest that enables DOHS to monitor the flow of waste from the point of generation to off-site disposal. Copies of the manifest eventually go from the generator to transporter to disposer, the generator submits a manifest to DOHS at the same time as to the transporter. A person who disposes of a hazardous waste must pay a disposal fee to the State Board of Equalization.

The Mission Bay project could come under the provisions of the law and it is likely that its provisions would act in place of RCRA. The determination of who would be responsible for implementation of HWCL or RCRA, as applicable, would be made by EPA and DOHS.

California Porter Cologne Water Quality Act (CPCWQA) of 1970 establishes a statewide system for water regulations that operates at three levels: State Water Resources

Control Board (SWRCB), Regional Water Quality Control Board (RWQCB), and local government. The SWRCB has the overall responsibility for developing and implementing a statewide water quality policy. The SWRCB is designated as the state water pollution control agency for all purposes stated in the Federal Water Pollution Control Act (United States Code Title 33 Section 1251 et seq.). The SWRCB is required to ensure adequate protection of water quality and statewide uniformity in siting, operation and closure of waste disposal sites. As per the Calderon Bill (Assembly Bill 129, 1984), the SWRCB was required to rank all solid waste disposal sites based on their threat to water quality.

RWQCBs are required to establish water quality objectives for their regions. Tasks in the management of hazardous wastes include classification of all proposed or currently operating waste disposal sites; review of facility closure and maintenance reports submitted to DOHS; and determination of the adequacy of plans to protect water quality. RWQCBs are the designated state agency for implementation of the Porter Cologne Water Quality Act.

Any person discharging or proposing to discharge waste that could affect the quality of state waters is required to file a report of waste discharge with the appropriate RWQCB. Any person, without regard to intent or negligence, who causes or permits any reportable quality of hazardous substances or wastes to be discharged in or on any waters of the state must immediately notify the California Office of Emergency Services and the RWQCB. State waters are defined as any surface or ground water, including saline water, within the boundaries of the state (Section 13050(e) Water Code). A RWQCB may issue a cease and desist order and a clean-up or abatement order if determined necessary. Additionally, a property owner may be required to take appropriate remedial action when a RWQCB finds that a condition of pollution or nuisance exists that has resulted from a non-operating business. A non-operating business is one in which routine business operations are not being conducted.

Leaking underground storage tanks (USTs) must be reported to the appropriate RWQCB and, in the case of Mission Bay, the agency would be the San Francisco Bay Regional Water Quality Control Board. The RWQCB would then take action to mandate clean-up of soil, surface or ground waters, including any seepage into the Bay. Other agencies may become involved in this process depending on the level of contamination. For example, DOHS could become involved as the clean-up may pertain to hazardous materials, a local fire department may be called in to inspect or test any residual contamination to ensure no fire or explosive hazard remains. The San Francisco Department of Public Health Environmental Health Division also would become involved in site mitigation under AB 1362 (1983), known as the Sher Bill. The Sher Bill regulates UST monitoring, closure and clean-up and, as provided in the bill, local governments may adopt more stringent UST regulations. The City and County of San Francisco adopted such an ordinance prior to 1984 and amended it in 1986.

<u>Assembly Bill 1362 (AB 1362), Sher, Hazardous Substances: Underground Storage Tanks 1983</u> prohibits any person from owning or operating an underground storage tank (UST) used for the storage of hazardous materials without a permit from the local agency. The bill also requires the permit to include a description of types and quantities of substances to be stored in each tank, diagram of tanks, name and phone number of 24-hour contact person, address of facility and description of the monitoring program. The bill also requires local agency inspection of premises at least once every three years. The bill authorizes a local agency to enter any place where USTs are located for inspections, testing, obtaining samples, copying records and authorizes these persons to enter property for inspection within 2,000 feet of such a place. The bill requires that all USTs installed after January 1, 1984 comply with certain requirements concerning design, construction, monitoring, and drainage and requires that all USTs installed on or before that date have a

monitoring system installed before January 1, 1985. The bill exempts USTs used for motor fuel storage installed after January 1, 1984 from certain design and construction standards.

The bill requires that unauthorized releases be recorded and reported by the owner or operator to the local agency within 24 hours. The bill authorizes a local agency to request the RWQCB to take corrective action. The bill prohibits a person from abandoning, closing or temporarily ceasing to operate an UST unless certain actions are taken by that person. The provisions of this bill and additional regulations by the City and County of San Francisco are applicable to the project. The San Francisco Department of Public Health Environmental Health Division is the designated local implementing agency (see discussion under "Local Regulations").

Assembly Bill 2040, (AB 2040) 1986, requires owners or operators of commercial or industrial buildings to make a good-faith effort to determine if asbestos-containing material is present prior to contracting for or beginning asbestos-related work, including renovation work which could disturb asbestos-containing materials. Senate Bill 2572 (SB 2572) 1986, strengthened AB 2040 by making it a certain penalty for any failure to determine the presence of asbestos-containing material, rather than, as worded in AB 2040, "failure to make as good faith effort." Asbestos-containing materials, as defined in SB 2572, include construction materials which contain more than 0.1% asbestos by weight. Asbestos-related work is defined as any activity which by disturbing asbestos-containing construction materials may release asbestos fibers into the air. AB 2040 further requires state certification for any contractor whose operations include asbestos-related work.

The project, therefore, would have to determine if asbestos is present in any building materials before any demolition, renovation or remodeling of structures occurs. If asbestos is found to be present, a state-licensed contractor who has passed an asbestos certification examination must remove the materials. Permits from the BAAQMD may be required for monitoring and containment of friable (airborne) asbestos. Disposal of asbestos and asbestos-containing materials would come under the regulation of RCRA or HWCL.

California Administrative Code, Title 22, Division 4, Environmental Health (22 CAC). Under the authority of the Hazardous Waste Control Law (Health and Safety Code, Division 20, Chapter 6.5, Section 25141), this code lists 791 hazardous and extremely hazardous chemicals and 20 to 30 more-common materials that may be hazardous (Article 9); establishes criteria for identifying hazardous materials (Article 11); describes managements of hazardous wastes (Articles 6 and 7); establishes permits for hazardous waste storage and disposal facilities (Article 4) and for hazardous waste haulers (Article 5); and identifies some hazardous materials that cannot be land disposed of on land (Article 15). This code gives DOHS authority to enter a suspected hazardous waste site and take samples (Section 66328). The Director of the DOHS can order persons to take specified actions concerning wastes, if needed to prevent violations of regulations or protect public health (Section 55336).

California Administrative Code, Title 23 Waters, Chapter 3 Water Resources Control Board Subchapter 16 Underground Storage Tank Regulations sets forth underground storage tank construction and monitoring standards, existing underground storage tank monitoring standards, release reporting requirements, and closure requirements.

Assembly Bill 2185, (AB 2185) 1986, requires businesses handling hazardous materials, as defined, to establish a business plan and submit such plan to administering agency (i.e., city or county). Plan must be in accordance with standards adopted by State Office of

Emergency Services for emergency response to a release or threated release of hazardous material. Handler is required to report threatened and actual releases. Requires businesses to inventory hazardous materials and file such inventory with administering agency. Requires administering agency to establish an area plan for emergency response. Requires that business plans have 24-hour availability to emergency rescue personnel. Provides mechanism for administering agency to impose a fee on business required to submit business plan.

Assembly Bill 2187, (AB 2187) 1986, prohibits any city from implementing AB 2185 unless it has enacted an implementing ordinance or adopted an implementing resolution within 60 days after Office of Emergency Services (OES) adopts regulations unless it has agreement with the County that it may do so. Expands intent of AB 2185 to include cities (cities now required to develop and submit area plan to OES). This bill defines "store" to exclude storage of material in transit (i.e., materials in transit could be exempt from inventory). Requires administering agency to exempt farms from certain requirements of the business plan. Allows the administering agency to exempt certain hazardous materials from the inventory requirements provided certain findings are met.

Requires inventory to be filed on or before January 1, 1988 and annually thereafter, and requires business plan to be reviewed on or before January 1, 1988, and at least once every two years thereafter. Requires that information on inventory be able to be provided to emergency rescue personnel on a 24-hour basis by the administering agency.

Assembly Bill 3777, (AB 3777) 1986, extends date of submission of business plans as provided for on AB 2185 to January 1, 1988. Requires every business, except as specified, that handles specified amounts of acutely hazardous materials to file an acutely hazardous materials registration form with the administering agency on or before September 1, 1987. This bill requires a business to inventory hazardous substances and to include total estimated amounts of each hazardous waste handled throughout one year. Also allows an administering agency to require a handler to submit a certified risk management and prevention program (RMPP). Allows administering agency to enter and inspect business facilities subject to RMPP.

LOCAL REGULATIONS

- San Francisco "Analyzing the Soil for Hazardous Wastes" Ordinance #253-86 Part II, Chapter 10 Public Works Code, Article 20, San Francisco Municipal Code establishes, as of June 27, 1986, and as amended August 2, 1988, the requirement for a hazardous wastes analysis in conjunction with applications for certain building permits. A hazardous wastes analysis consisting of a soil analysis and site history is required for building permits if more than 50 cubic yards of soil are to be disturbed, and either the site is bayward of the historic high tide line as indicated on a map of San Francisco, available from the Department of Public Works, or is otherwise required by the Director of Public Works. If evidence of soil contamination is found, a site mitigation plan must be submitted, approved, and carried out prior to issuance of a building permit. The types of analyses must include inorganic persistent and bioaccumulative toxic substances listed in 22 CAC, Section 66699; volatile organic toxic pollutants listed for 40 CFR, Part 122, Appendix D Table 11; PCBs, pH levels; flammability; cyanides; sulfides; methane and other flammable gasses; and any other hazardous wastes designated by the Directors of Public Works or Public Health.

Soil samples are to be analyzed by a certified laboratory in accordance with methods approved by the DOHS or SWRCB and the San Francisco Bay RWQCB. The soils analysis report must be submitted to the Director of Public Works and the Director of Public Health by the firm conducting the soil sampling and analyses.

- The Director of Public Health will notify the applicant and the Director of Public Works in writing if the report indicates there are no hazardous wastes present in the soil. Thereafter, the Director of Public Works will approve or deny a building permit application. If, on the other hand, hazardous wastes are detected in the soil samples, a site mitigation report must be prepared by a "qualified person" and implemented by the applicant before the Department of Public Works will act on the building permit application. The site mitigation report will describe any problems posed by the hazardous wastes and explain how the material will be handled in order to minimize threats to public health and safety. As part of report preparation, additional soil sampling might be called for to define the extent of contamination.

- The site mitigation report will contain the following information:

- (1) A determination by the qualified person whether the hazardous wastes in the soil pose significant environmental health and safety risks, and if so, detailed measures recommended to mitigate those risks.

- (2) A statement signed by the report preparer certifying that he/she is qualified within the meaning of the law, and that the mitigation measures identified in the report will mitigate significant environmental or health and safety risks.

- Persons qualified to prepare site mitigation reports include registered environmental assessors, engineers, and geologists, and certified industrial hygienists.

- When completed, the site mitigation report will be submitted to the Department of Public Health and the Department of Public Works. Upon receipt of the report and at the applicant's request, the Director of Public Works will issue any permits necessary for the applicant to carry out site mitigation, and clean-up work can proceed accordingly.

- To complete the process, the applicant must certify under penalty of perjury that either:

- (1) the qualified person has determined that no hazardous materials in the soil are causing or are likely to cause significant environmental or health and safety risks, and the qualified person recommends no mitigation measures, <u>or</u>

- (2) the applicant has performed all mitigation measures recommended, and has verified that mitigation is complete, <u>or</u>

- (3) the applicant has received third-party certification from the appropriate state or federal agency that mitigation is complete.

- Certification must also contain a formal statement that the applicant remains responsible for site mitigation and retains any associated liabilities.

- Upon receipt of the soil analysis report, the site mitigation report (if necessary) and final certification from the applicant that mitigation either is unnecessary <u>or</u> has been completed, the Director of Public Health will so notify the Director of Public Works in writing. Thereafter, the Director of Public Works will consider the building permit application to be complete and may approve or deny the application.

<u>San Francisco Hazardous Materials Permits and Disclosure Ordinance #443-86, Health Code Part II, Chapter V, Article 21 San Francisco Municipal Code</u>. As of July 1986, the ordinance established a comprehensive system for processing permits and monitoring the use, storage, and disposal of hazardous materials. The process provides for hazardous materials identification, disclosure, management plans and intergovernmental

notification and review of permits. This ordinance also established specific design and construction standards for underground storage tanks (USTs). The ordinance outlines provisions for handling abandoned USTs, as well as for maintenance of existing facilities. Persons owning, leasing, or renting property who have reason to believe that an abandoned UST is located upon their property must identify such a facility to the Director of Public Health within six months. Additionally, should the Director of Public Health suspect that an abandoned UST is located on a property, a notification will be served to the owner or lessee of the property. The notification will require the proper closure of the UST as per requirements contained in the ordinance. The Department of Public Health can require the removal of an UST if upon investigation it is deemed as necessary./3/ The project would have to conform with those regulations. When an abandoned UST is located, a plan for its closing or upgrading must be filed within 30 days.

Similarly, the ordinance states that any person who stores hazardous materials is responsible for the clean-up of any unauthorized or uncontrolled releases, whether sudden or gradual. The provisions of this ordinance also apply to any establishment or storage facility owned or leased by the state or federal government, or by any agency or department of the state or federal government.

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TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3795:	Townsend/3rd/Berry/4th				
2	ice house, meat packing, furniture, box factory, planing mill, glass works, lumber, railyard, freight storage, mill, propane storage	alkaline/acid solutions, Polycyclic Aromatic Hydrocarbons(PAH's), petro-fuel, Wood Treatment Compounds(WTC's), pesticides, halogenated organics and Heavy Metal Compounds (HMC's)	1,3,4,5	1,2,3,5	1,5,8
3	glass works, railroad storage and concourse, recreational vehicle park	alkaline/acid solutions, PAH's, petro-fuel, pesticides, and HMC's	1,3,4,5	1,2,3,5	5,8
4	boat building, glass works, rail terminal and concourse, recreational vehicle park	alkaline/acid solutions, PAH's, petro-fuel, pesticides, and HMC's	1,3,4,5	1,2,3,5	3,5,8
3796:	Townsend/4th/Berry/5th				
1	rail yard, aboveground storage of diesel fuel	alkaline/acid solutions, pesticides, petro-fuel, halogenated organics, and HMC's	1,3,4,5	1,2,3,5	8
2	rail yard and tracks	alkaline/acid solutions petro-fuel, pesticides, PAH's halogenated organics, and HMC's	1,3,4,5	1,2,3,5	8
3	antimony producer, coal oil storage, lubricating oil, lumber, rail storage and tracks, dumping	alkaline/acid solutions, PAH's pesticides, petro-fuel, WTCs, and HMC's	1,3,4,5	1,2,3,5	1,7,8

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3797:	Townsend/5th/Berry/6th				
1	rail tracks, repair, storage of coke, coal and batteries, automotive repair, blacksmith, oil storage, electrical generator, police station	alkaline/acid solutions, PAH's petro-fuel, pesticides, halogenated organics, and HMC's	1,3,4,5	1,2,3,5	7,8
2	agricultural storage, lumber yard, rail yard, storage and tracks, freight storage	alkaline/acid solutions petro-fuel, pesticides, halogenated organics, WTCs PAH's, and HMC's	1,3,4,5	1,2,3,5	1,8
3798:	Townsend/6th/Berry/7th				
1	rail yard	alkaline/acid solutions, petro-fuel, halogenated organics, pesticides, PAH's, and HMC's	1,3,4,5	1,2,3,5	8
2	rail yard, repair and storage, dumping, and diner, propane storage	alkaline/acid solutions, petro-fuel, pesticides, PAH's halogenated organics, and HMC's	1,3,4,5	1,2,3,5	7,8
3804:	4th/Channel/5th/Berry				
2	lumber, dumping	alkaline/acid solutions, WTC's and HMC's	1,4,5	1,4,5	1
4	vinegar works, lumber, rail tracks, yard and storage	alkaline/acid solutions, PAH's, petro-fuel, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,7,8
5	lumber, storage of oil coal and lubricant, antimony shop, dumping of garbage and autos	alkaline/acid solutions, PAH's, petro-fuel, halogenated organics, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,7,9

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3805:	5th/Channel/6th/Berry				
1	City dump, shipbuilding lumber, brick and concrete production, bus storage	alkaline/acid solutions, asbestos WTC's, HMC's, petro-fuel, PAH's, and halogenated organics	1,3,4,5	1,2,3,5	1,3,9
3806:	6th/Channel/7th/Berry				
6	shipbuilding, lumber, oil and gasoline storage, brick production, water treatment plant	alkaline/acid solutions, asbestos petro-fuel, PAH's, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,3,7
7	petrochemical producer, lumber, brick production and heavy metals, automotive junkyard	alkaline/acid solution halogenated organics, petro-fuel, PAH's, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,3,7
8	shipbuilding, oil barrel storage, brick production, rail tracks, channel pumping station	alkaline/acid solutions asbestos, petro-fuel PAH's, and HMC's	1,3,4,5	1,2,3,5	3,8

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3809:	Channel/7th/Owens/6th				
2	lumber, auto storage, garbage dumping	alkaline/acid solutions, PAH's, petro-fuel, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,9
4	lumber, wrecking company	alkaline/acid solutions, PAH's petro-fuel, WTC's and HMC's	1,3,4,5	1,2,3,5	1,9
6	lumber, waste treatment plant storage	alkaline/acid solutions, HMC's PAH's, and WTC's	1,4,5	1,2,5	1,9
7	lumber, rail tracks, garbage dumping	alkaline/acid solutions, petro-fuel, pesticides, PAH's, WTC's and HMC's	1,3,5	1,3,5	1,8,9
3810:	Channel/4th/3rd/16th/6th				
6	City dump, wharf, lumber	alkaline/acid solutions, PAH's petro-fuel, HMC's and WTC's	1,3,4,5	1,2,3,5	1,8,9
7	City dump, lumber, boiler house, rail yard, incinerator, blacksmith, freight storage, trucking, automotive repair, metal salvage, paint company,	alkaline/acid solutions, asbestos pesticides, paint solvents, HMC's petro-fuel, PAH's, and WTC's	1,2,3,4,5	1,2,3,4,5	0-9
3813:	Channel/3rd/4th				
1	lumber, warehouse, construction company, garbage dumping, and oil storage	alkaline/acid solution, PAH's, WTC's, petro-fuel, and HMC's	1,3,4,5	1,2,3,5	1,7,8,9

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3819:	6th/7th/Owens				
2	mineral company, lumber, metal working, construction yard wrecking company, auto storage	alkaline/acid solution petro-fuel, PAH's, WTC's, and HMC's,	1,3,5	1,3,5	1,2,9
3	brick producer, rock grinding, garbage dumping	alkaline/acid solution, and HMC's	1,5	1,5	2
3822:	6th/7th/Owens				
2	agricultural warehouses, lumber, oil and gasoline storage, auto storage, storage sheds	alkaline/acid solution, petro-fuel, halogenated organics, PAH's, HMC's, and WTC's	1,3,4,5	1,2,3,5	1,7,9
3	brick producer, lumber, fuel, company, rail tracks and auto storage	alkaline/acid solution pesticides, petro-fuel, PAH's, WTC's and HMC's	1,3,4,5	1,2,3,5	1,7,9
3832:	6th/7th/Owens				
2	brick producer lumber, junk yard, warehouse, storage of metal, paper company, and auto storage	alkaline/acid solution, paint solvents, petro-fuel, PAH's, WTC's and HMC's	1,3,4,5	1,2,3,5	1,9
3	lumber, garbage rail tracks, auto storage	alkaline/acid solutions, pesticides, petro-fuel, PAH's, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,8,9

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3835:	6th/7th/Owens/16th				
2	furniture company, boiler works, lumber, oil storage, auto storage, rail tracks	alkaline/acid solutions, halogenated organics, petro-fuel pesticides, PAH's, WTC's and HMC's	1,3,4,5	1,2,3,5	1,7,8
3	paper warehouse, fuel and road oil company, scrap metal yard, oil separation equipment, sump pumps, paint company, junk yard, auto storage, dumping of petroleum products	alkaline/acid solutions, pickle liquor, paint solvents, halogenated organics, petro-fuel, PAH's, and HMC's	1,2,3,4,5	1,2,3,4,5	6,8,9
3837:	3rd/4th/Illinois/Merrimac				
1	oil and coal storage, auto repair, rail tracks	alkaline/acid solutions, pesticides, petro-fuel halogenated organics, PAH's, and HMC's	1,3,4,5	1,2,3,5	7,8
2	lumber, planing mill	alkaline/acid solutions, PAH's, HMC's, and WTC's	1,4,5	1,2,5	1
4	railroad tracks, fire house	petro-fuel, PAH's	3,5	3	8
6	paint shop, lumber, gas and oil depot, underground storage of oil and gas, garbage dumping, auto storage	alkaline/acid solutions, benzene, petro-fuel, paint solvents, halogenated organics, PAH's, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,6,7,9
7	paint shop, gas and oil depot, storage of oil, coffee company	alkaline/acid solutions, petro-fuel, paint solvents halogenated organics, PAH's and HMC's	1,3,4,5	1,2,3,5	6,7

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3838:	Illinois/4th/Merrimac				
1	oil storage, glass warehouse, freight and auto storage	alkaline/acid solutions petro-fuel, and HMC's	1,3,5	1,3,5	1,7
2	freight warehouse, auto storage	alkaline/acid solutions, petro-fuel	1,3	3,5	1
3	rail tracks, possible dumping	pesticides, petro-fuel	3,4	2,3	1,8
3839:	4th/Alameda/China Basin				
1	freight storage, auto storage	alkaline/acid solutions, petro-fuel	1,3	3,5	1
2	freight storage, rail tracks, service station, oil sumps, fuel storage	alkaline/acid solutions, petro-fuel, pesticides, halogenated organics, PAH's, and HMC's	1,3,4,5	1,2,3,5	1,7,8
3840:	Illinois/Alameda/Merrimac				
1	oil warehouse, lumber/metal stockyard, freight storage, rail tracks, auto storage	alkaline/acid solutions, pesticides, petro-fuel, PAH's, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,7,8
2	auto storage	alkaline/acid solutions petro-fuel	1,3	3,5	0
3	lumber/metal storage, auto storage, freight storage	alkaline/acid solutions, petro-fuel, HMC's PAH's and WTC's	1,3,4,5	1,2,3,5	1

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3841:	3rd/Merrimac/Illinois/Alameda				
1	train repair yard, rail tracks, coal storage, chemical warehouse, cement mixing	alkaline/acid solutions, petro-fuel, pesticides, PAH's, halogenated organics, asbestos, and HMC's	1,3,4,5	1,2,3,5	7,8
2	chemical warehouse, rail tracks, repair yard, cement mixing	alkaline/acid solutions pesticides, petro-fuel, asbestos, PAH's, and HMC's	1,3,4,5	1,2,3,5	8
3	rail tracks, repair yard, junk yard, aboveground storage tanks, cement mixing	alkaline/acid solutions, petro-fuel, asbestos, PAH's, and HMC's	1,3,5	1,3,5	8,9
3849:	3rd Illinois/El Dorado/Alameda				
1	rail tracks, train storage, machine shop, boiler house, oil company	alkaline/acid solutions, petro-fuel, halogenated organics, asbestos, PAH's, and HMC's	1,3,4,5	1,2,3,5	8,9
2	Same as parcel #1	Same as parcel #1	1,3,4,5	1,2,3,5	8,9
3850:	Alameda/Illinois/El Dorado				
1	freight storage, junk yard, auto storage	alkaline/acid solutions, petro-fuel, and HMC's	1,3,5	1,3,5	9
1A	Same as parcel #1	Same as parcel #1	1,3,5	1,3,5	9
1B	Same as parcel #1	Same as parcel #1	1,3,5	1,3,5	9
2	freight and auto storage	alkaline/acid solutions and petro-fuel	1,3	3,5	9
3851:	El Dorado/Alameda				
1	rail tracks, auto storage, garbage dumping	alkaline/acid solutions, pesticides, petro-fuel, and HMC's	1,3,4,5	1,2,3,5	8,9

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3852:	El Dorado/Alameda/China Basin				
1	freight storage, rail tracks, auto storage	alkaline/acid solutions, petro-fuel, pesticides	1,3,4	2,3,5	1,8
2	lime & hydrate producer lumber, rail yard and tracks	alkaline/acid solutions, pesticides, petro-fuel, PAH's, halogenated organics, WTC's, and HMC's	1,3,4,5	1,2,3,5	1,8
3853:	16th/3rd/Illinois				
1	junk yard, sand/gravel yard	alkaline/acid solutions, and HMC's	1,5	1,5	9
3880:	3rd/4th/China Basin				
1	train enginehouse, rail tracks, train storage, freight storage, oil storage, oil sumps, trucking, auto maintenance, hazardous waste transfer facility	alkaline/acid solutions petro-fuel, pesticides, PAH's halogenated organics, HMC's and unknown hazardous waste	1,3,4,5	1,2,3,5	7,8,9
3892:	16th/Illinois/El Dorado/ China Basin				
1	crude oil storage, rail tracks, lumber, trucking activities, junk yard, gasoline/diesel service islands	alkaline/acid solutions, petro-fuel, pesticides, PAH's halogenated organics, WTC's and HMC's	1,3,4,5	1,2,3,5	1,7,8,9
3940:	Illinois/16th/China basin				
1	shipyard, oil production and storage, parking	alkaline/acid solutions, petro-fuel, halogenated organics, PAH's, and HMC's	1,3,4,5	1,2,3,5	3,7
2	lumber, rail tracks	alkaline/acid solutions, pesticides, petro-fuel, HMC's, PAH's, and WTC's	1,3,4,5	1,2,3,5	1,8

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3941:	Illinois/China Basin				
1	lumber, shipbuilding, asbestos plant, shipping activities	alkaline/acid solutions, petro-fuel, halogenated organics, asbestos, PAH's, HMC's, WTC's	1,3,4,5	1,2,3,5	1,2,3
3942:	3rd/Illinois/Mariposa/16th				
2	rail tracks, oil production, auto storage, refrigeration company	alkaline/acid solutions, petro-fuel, halogenated organics, PAH's	1,3,4	2,3,5	1,7,8
3	auto storage, refrigeration company	alkaline/acid solutions, petro-fuel, halogenated organics	1,3,4	2,3,5	1
4	oil production, rail tracks, metal rolling mill, storage tanks, garbage dumping, building materials, cement mixing, refrigeration company	alkaline/acid solutions, asbestos, petro-fuel, PAH's, and HMC's	1,3,5	1,3,5	1,3,7,8
3943:	16th/3rd				
6	crude oil storage, oil sump, auto storage, auto junk yard, dumping	alkaline/acid solutions petro-fuel, PAH's, and HMC's	1,3,4,5	1,2,3,5	7,8,9
3944:	16th/3rd/Pennsylvania/Mariposa				
4	rail roundhouse, machine shops, boiler, oil storage, rail tracks, engine house, oil sumps, paint shops, propane storage, electric supply, dumping, rail tracks, auto storage	alkaline/acid solution, petro-fuel, pesticides, PAH's halogenated organics, paint solvents, and HMC's	1,3,4,5	1,2,3,5	7,8,9

(continued)

TABLE XIV.L.2: TYPES OF INDUSTRY AND POTENTIAL CONTAMINANTS BY PARCEL (continued)

Assessor Parcel	Types of Production	Potential Contaminants	Degradation Persistence/a/	Migration Potential/a/	Hazard Categories/b/
3948:	16th/Pennsylvania/7th				
1	paint mill, roofing and refining company, rail tracks	alkaline/acid solutions pesticides, petro-fuel, PAH's paint solvents, PAH's, and HMC's	1,3,4,5	1,2,3,5	6,7,8

/a/ See Table XIV.L.4.
/b/ 0 = non-hazardous; 1 = non-hazardous in view of known facts; 2 = asbestos processors; 3 = steel-rolling, ship and boat building; 4 = chemical companies; 5 = glass companies; 6 = paint companies; 7 = petroleum product storage; 8 = rail yards; 9 = dumps and junk yards (Scott Lynn, "Evaluation of Potential Hazards from Previous Industrial Activities at the Mission Bay Development Site," prepared for Environmental Science Associates, Inc. April 12, 1987).

SOURCE: Environmental Science Associates, Inc.

TABLE XIV.L.3: KEY INDUSTRIES FOR HAZARDOUS MATERIALS ASSESSMENT

SIC/a/	Name
0721	Crop Planting, Cultivating and Protection
2295	Coated Fabrication
2611	Paper Mills
2621	Pulp Mills
2812	Alkalies and Chlorine
2819	Industrial Inorganic Chemicals, NEC
2821	Plastic Materials, Synthetic Resins and Non-Vulcanizable Elastomers
2842	Specialty Cleaning, Polishing and Sanitary Preparation
2851	Paints, Varnishes, Lacquers, Enamels and Allied Products
2861	Gum and Wood Chemicals
2865	Cyclic Crudes, Cyclic Intermediates, Dyes and Organic Pigments
2869	Industrial Organic Chemicals, NEC
2873	Nitrogenous Fertilizers
2874	Phosphatic Fertilizers
2879	Pesticides and Agricultural Chemicals, NEC
2891	Adhesives and Sealants
2892	Explosives
2899	Chemicals and Chemical Preparations, NEC
2911	Petroleum Refining
3111	Leather Tanning and Finishing
3312	Blast Furnace
3471	Electroplating, Plating, Polishing, Anodizing and Coloring
3573	Electronic Computing Equipment
3632	Household Refrigerators and Home Farm Freezers
3674	Semi-Conductors and Related Devices
3679	Electronic Components, NEC
3731	Shipbuilding and Repair
3861	Photographic Equipment and Supplies
4225	General Warehousing and Storage
4226	Special Warehousing and Storage, NEC
4613	Refined Petroleum Pipelines
4911	Electric Services
4931	Electric and Other Services Combined
4923	Natural Gas Transmission and Distribution
4925	Mixed, Manufactured or Liquefied Petroleum Gas Production and/or Distribution
4952	Sewage Systems
4953	Refuse Systems
5161	Chemical and Allied Products
5171	Gasoline Bulk Plants
5172	Petroleum and Petroleum Wholesalers, except Bulk Station and Terminals

/a/ Standard Industrial Classification

SOURCE: Association of Bay Area Governments, 1982.

TABLE XIV.L.4: SUMMARY OF PROPERTIES OF HAZARDOUS SUBSTANCES

Chemical/ Substance/Formula	Common Synonyms	Hazard Classifications	Physical Properties	Chemical Properties	Persistence in Ground	Migration Potential
Acetone/ CH_3COCH_3	Dimethyl Ketone, Propanone, 2-Propanone	1. Flammable liquid 2. Category: Rating: Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 0 Poisons 0 Water Pollution Human Toxicity 1 Aquatic Toxicity 1 Aesthetic Effect 1 Reactivity Other Chemicals 1 Water 2 Self Reaction 0 3. Category: Class: Health Hazard (Blue) 1 Flammability (Red) 3 Reactivity (Yellow) 0	A colorless liquid, with a sweet odor. Floats and mixes with water. Flammable, irritating vapor	Miscible in water. Molecular weight=58.08 Specific gravity=0.79 Melt point=-95°C Boil point=+56°C Vapor pressure at 25°C=263mm Hg	II	IV
Arsenic Disulfide/ As_2S_2	Realgar, Red Arsenic glass, red arsenic sulfide, red orpiment, ruby arsenic	1. Poison B 2. Not listed 3. Not listed 4. Extremely toxic	Red-brown solid, odorless. Sinks in water.	Insoluble in water. Molecular weight=214.	III	II
Arsenic Trisulfide/ As_2S_3	Arsenic yellow, King's gold, King's yellow, Orpiment, Yellow arsenic sulfide.	1. Poison B 2. Not listed 3. Not listed 4. Extremely toxic	Yellow-orange solid. Odorless. Sinks in water.	Insoluble in water. Molecular weight=246.	III	II
Asbestos/ Silicate Mixture	--	Not Listed	White, filamentous solid. Non-flammable.	Insoluble in water.	V	II

(continued)

TABLE XIV.L.4: SUMMARY OF PROPERTIES OF HAZARDOUS SUBSTANCES (continued)

Chemical/ Substance/Formula	Common Synonyms	Hazard Classifications		Physical Properties	Chemical Properties	Persistence in Ground	Migration Potential
Automotive Fuels/ Mixture of Hydrocarbons	Motor spirit, Petrol	1. Flammable liquid 2. Category: Fire Health Vapor Irritant Liquid or Solid Irritant Poisons Water Pollution Human Toxicity Aquatic Toxicity Aesthetic Effect Reactivity Other Chemicals Water Self Reaction 3. Category: Health Hazard (Blue) Flammability (Red) Reactivity (Yellow)	 Rating: 3 1 1 2 1 2 2 0 0 0 Class: 1 3 0	Colorless to pale brown or pink. Watery liquid. Gasoline odor.	Insoluble in water.	V	IV
Benzene/ C_6H_6	Benzol, Benzole	1. Flammable liquid 2. Category: Fire Health Vapor Irritant Liquid or Solid Irritant Poisons Water Pollution Human Toxicity Aquatic Toxicity Aesthetic Effect Reactivity Other Chemicals Water Self Reaction 3. Category: Health Hazard (Blue) Flammability (Red) Reactivity (Yellow) 4. Toxic, Ignitable	 Rating: 3 1 1 3 3 1 3 2 1 0 Class: 2 3 0	Colorless, watery liquid. Gasoline-like odor. Floats on water. Flammable, irritating vapor is produced.	Soluble in water. Molecular weight=78.11 Specific gravity=0.88 Melt point=+5.5°C Boil point=80.1°C Vapor pressure at 25°C=95mm Hg	II	IV
Cadmium Oxide/ CdO	Cadmium fume	1. Not listed 2. Not listed 3. Not listed 4. Toxic		Yellow-brown to brown solid. Odorless. Sinks in water.	Insoluble in water. Molecular weight=128.4	III	II

(continued)

TABLE XIV.L.4: SUMMARY OF PROPERTIES OF HAZARDOUS SUBSTANCES (continued)

Chemical/ Substance/Formula	Common Synonyms	Hazard Classifications	Physical Properties	Chemical Properties	Persistence in Ground	Migration Potential
Calcium Oxide/ CaO	Unslaked lime, Quicklime	1. ORM-B 2. Not listed 3. Category: Class: Health Hazard (Blue) 1 Flammability (Red) 0 Reactivity (Yellow) 1 4. Corrosive	White to grey, solid granules. Odorless. Sinks and reacts violently with water.	Reacts with water. Molecular weight=56.08	III	II
Chromic Anhydride/ CrO_3	Chromic oxide, Chromium trioxide, Chromic acid	1. Oxidizer 2. Not listed 3. Category: Class: Health Hazard (Blue) 3 Flammability (Red) 0 Reactivity (Yellow) 1 4. Toxic, corrosive, and ignitable	Dark red, solid flakes or powder. Odorless. Sinks and mixes with water.	Soluble in water. Molecular weight=100.01	III	II
Copper acetate/ $Cu(C_2H_3O_2)_2$	Acetic acid, cupric salt, crystallized verdigris, netural verdigris, cupric acetate monohydrate.	1. Not listed 2. Not listed 3. Not listed 4. Not listed	Bluish-green solid. Odorless. Mixes with water.	Soluble in water. Molecular weight=199.65	III	II
Copper Acetoarsenite/ $3Cu(AsO_2)_2$ $.Cu(C_2H_3O_2)_2$	Paris green, Schweinfurth Imperial green, Emerald green, moss green	1. Poison B 2. Not listed 3. Not listed 4. Extremely toxic	Green, solid powder. Odorless. Sinks and mixes slowly with water.	Soluble in water. Molecular weight=1014.	III	II
Creosote, Coal Tar/ Mixture	Creosote oil dead oil	1. Combustible liquid 2. Category: Rating: Fire 1 Health Vapor Irritant 2 Liquid or Solid Irritant 3 Poisons 2 Water Pollution Human Toxicity 2 Aquatic Toxicity 3 Aesthetic Effect 4 Reactivity Other Chemicals 1 Water 0 Self Reaction 0 3. Category: Class: Health Hazard (Blue) 2 Flammability (Red) 2 Reactivity (Yellow) 0 4. Not listed	Yellow to black liquid. Tarry. odor. May float or sink in water.	Insoluble in water.	V	III

(continued)

TABLE XIV.L.4: SUMMARY OF PROPERTIES OF HAZARDOUS SUBSTANCES (continued)

Chemical/ Substance/Formula	Common Synonyms	Hazard Classifications	Physical Properties	Chemical Properties	Persistence in Ground	Migration Potential
DDD/ $C_{14}H_{10}Cl_4$	TDE, 1,1-Dichloro-2,2-bi-(p-Chlorophenyl)-ethane, Dichloro-diphenyldichloro-phenylethane	1. Not listed 2. Not listed 3. Not listed 4. Not listed	White solid. Sinks in water.	Molecular weight=320.	V	III
DDT/ $C_{14}H_9Cl_5$	Dichlorodiphenyl trichloro-ethane, p,p'-DDT, 1,1,1-Trichloro-2, 2-bis(p-chlorophenyl ethane)	1. ORM-A 2. Not listed 3. Not listed 4. Toxic	Colorless solid. Odorless. Sinks in water.	Insoluble in water. Molecular weight=354.5	V	III
2,4-D/ $C_7H_4O_3Cl_2$	2,4-Dichloro-phenoxy-acetic acid	1. ORM-A 2. Not listed 3. Not listed 4. Extremely toxic	White to tan solid. Odorless. Sinks in water.	Soluble in water. Molecular weight=221.0	V	III
Fuel Oil/ An oil-based mixture of organic compounds	Diesel Oil (light)	1. Combustible liquid 2. Not listed 3. Category: Class: Health Hazard (Blue) 0 Flammability (Red) 2 Reactivity (Yellow) 0 4. Not listed	A yellow-brown oil. Lube or fuel oil odor. Floats on water.	Insoluble in water.	V	IV
Magnesium/ Mg		1. Flammable solid 2. Not listed 3. Category: Class: Health Hazard (Blue) 0 Flammability (Red) 1 Reactivity (Yellos) 2 4. Not listed	Silvery solid. Odorless. Sinks in water.	Insoluble in water. Molecular weight=24.3	III	II
Mercury/ Hg	Quicksilver	1. ORM-B 2. Not listed 3. Not listed 4. Extremely toxic	Silver liquid. Odorless. Sinks in water.	Insoluble in water. Molecular weight=200.59	III	II

(continued)

TABLE XIV.L.4: SUMMARY OF PROPERTIES OF HAZARDOUS SUBSTANCES (continued)

Chemical/ Substance/Formula	Common Synonyms	Hazard Classifications	Physical Properties	Chemical Properties	Persistence in Ground	Migration Potential
Nitric Acid/ HNO_3		1. Oxidizer 2. Category: Rating: Fire 0 Health Vapor Irritant 3 Liquid or Solid Irritant 4 Poisons 3 Water Pollution Human Toxicity 3 Aquatic Toxicity 3 Aesthetic Effect 2 Reactivity Other Chemicals 4 Water 0 Self Reaction 0 3. Category: Class: Health Hazard (Blue) 3 Flammability (Red) 0 Reactivity (Yellow) 0 4. Toxic, corrosive, ignitable	Clear to light brown liquid. Choking odor. Sinks and mixes with water. Harmful vapor is produced.	Miscible in water. Molecular weight=63.01 Specific gravity=1.50 Melt point=-42°C Boil point=+83°C Vapor pressure at 25°C=65mm Hg	II	V
Pentachlorophenol/ C_6Cl_5OH	Dowicide 7, Penta, Santophen 20	1. ORM-E 2. Not listed 3. Category: Class: Health Hazard (Blue) 3 Flammability (Red) 0 Reactivity (Yellos) 0 4. Not listed	White to light brown. Solid beads or flakes.	Soluble in water. Molecular weight=266.35	V	III
Polychlorinated biphenyl/ $C_{12}H_xCl_x$ (mixture)	PCB, Chlorinated biphenyl, Arochlor, Halogenated waxes, Polychloropolyphenyls.	1. ORM-E 2. Not listed 3. Not listed 4. Extremely toxic	Oily yellow liquid to. white powder Weak odor. Sinks in water.	Insoluble in water.	V	III
Selenium Dioxide/ SeO_4	Selenium oxide, Selenious anhydride	1. Poison B 2. Not listed 3. Not listed 4. Extremely toxic	White solid. Sour odor. Sinks and mixes with water.	Soluble in water. Molecular weight=111	III	II

(continued)

TABLE XIV.L.4: SUMMARY OF PROPERTIES OF HAZARDOUS SUBSTANCES (continued)

Chemical/ Substance/Formula	Common Synonyms	Hazard Classifications	Physical Properties	Chemical Properties	Persistence in Ground	Migration Potential
Sulfuric acid/ H_2SO_4	Oil of vitriol, battery acid	1. Corrosive material 2. Category: Rating: Fire 0 Health Vapor Irritant 2 Liquid or Solid Irritant 4 Poisons 2 Water Pollution Human Toxicity 2 Aquatic Toxicity 3 Aesthetic Effect 2 Reactivity Other Chemicals 4 Water 3 Self Reaction 0 3. Category: Class: Health Hazard (Blue) 3 Flammability (Red) 0 Reactivity (Yellow) 2 4. Toxic, Corrosive, Ignitable	A colorless oil. Odorless. Sinks and mixes violently with water. Irritating mist is produced.	Miscible in water. Molecular weight=98.08 Specific gravity=1.83 Melting point=+10.4°C Boiling point=338°C	II	V
Tetraethyl lead/ $Pb(C_2H_5)_4$	Lead tetraethyl	1. Not listed 2. Not listed 3. Category: Class: Health Hazard (Blue) 3 Flammability (Red) 3 Reactivity (Yellow) 3 4. Toxic, Ignitable	Colorless, oily liquid with slight musty odor.	Insoluble in water. Molecular weight=323.44 Specific gravity=1.66 Melting point=-136.8°C Boiling point=+200°C(d)	II	III
Tetramethyl lead/ $Pb(CH_3)_4$	Lead tetramethyl	1. Not listed 2. Not listed 3. Category: Class: Health Hazard (Blue) 3 Flammability (Red) 3 Reactivity (Yellow) 3 4. Toxic, Ignitable	A colorless oil. Fruity odor. Sinks in water. A poisonous, flammable vapor.	Slightly soluble in water. Molecular weight=267.33 Specific gravity=1.99 Melting point=-27.5°C Boiling point=+110°C	II	III

(continued)

TABLE XIV.L.4: SUMMARY OF PROPERTIES OF HAZARDOUS SUBSTANCES (continued)

Chemical/ Substance/Formula	Common Synonyms	Hazard Classifications	Physical Properties	Chemical Properties	Persistence in Ground	Migration Potential
Toluene/ $C_6H_5CH_3$	Toluol, methylbenzene	1. Flammable liquid 2. Category: Rating: Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Poisons 2 Water Pollution Human Toxicity 1 Aquatic Toxicity 3 Aesthetic Effect 2 Reactivity Other Chemicals 1 Water 0 Self Reaction 0 3. Category: Class: Health Hazard (Blue) 2 Flammability (Red) 3 Reactivity (Yellow) 0 4. Toxic, Ignitable	A colorless liquid. Pleasant odor. Floats on water. Flammable, obnoxious vapor.	Insoluble in water. Molecular weight=92.14 Specific gravity=0.87 Melt point=-95°C Boil point=110.6°C Vapor pressure at 25°C=32 mm Hg	II	IV
2,4,5-T/ $C_7H_3O_3Cl_3$	2,4,5-Trichloro-phenoxyacetic Acid-	1. ORM-A 2. Not listed 3. Not listed 4. Extremely toxic	White solid. Odorless. Sink in water. Dioxin may be present as an impurity.	Soluble in water. Molecular weight=255.5	V	III
Xylene/ $C_6H_4(CH_3)_2$	Xylol	1. Flammable liquid 2. Category: Rating: Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Poisons 2 Water Pollution Human Toxicity 1 Aquatic Toxicity 3 Aesthetic Effect 2 Reactivity Other Chemicals 1 Water 0 Self Reaction 0 3. Category: Class: Health Hazard (Blue) 2 Flammability (Red) 3 Reactivity (Yellow) 0	A colorless, liquid. Sweet odor. Floats on water. A flammable, irritating vapor.	Insoluble in water. Molecular weight=106.16	V	IV

ENVIRONMENTAL FATE/RISK ASSESSMENT

This section of Appendix L. discusses environmental behavior and risk factors for contaminants potentially present in the Project Area. For each contaminant, the following topics are discussed: general properties, assumptions, pathways of contamination or exposure, environmental fates, primary receptors or those most at risk, and a summary of the contaminant's most hazardous properties./1/

CONTAMINANT: Acetone (C_3OH_6)

General: Acetone is a highly volatile liquid with a characteristic sweet odor. It is flammable and completely miscible with water. In an open container, it evaporates very quickly. Acetone is classified as a hazardous waste by the EPA.

Assumptions: Acetone could remain on the site for a substantial period only if it were held in a sealed container. It may have been used at the site as an industrial solvent. Acetone is highly mobile in the environment in both air and water, and could not persist if free in the soil or in an unsealed container.

Pathways: Acetone evaporates rapidly if spilled. It dissolves immediately and completely in water. As a liquid, it could flow into soil and groundwater if spilled in large quantities. Acetone is highly mobile and would not persist on-site.

Fates: Acetone is a relatively stable compound. It is nonreactive with water and other common materials. It does react with strong acids and with oxidizing agents. As an organic hydrocarbon, it ultimately oxidizes in the environment.

Receptors: The primary receptors would be workers on the site or people exposed to contaminated groundwater. Acetone is a mild narcotic that irritates the eyes and the respiratory system. The effects are temporary. Acetone can be absorbed through inhalation, skin and eye contact, or ingestion. It is hazardous to aquatic wildlife.

Summary: Acetone is not likely to persist on the site unless it is stored in sealed containers. Spilled acetone volatilizes very quickly. The greatest acetone hazard is its flammability.

CONTAMINANT: Arsenic Disulfide (As_2S_2) and Arsenic Trisulfide (As_2S_3)

General: All arsenic compounds are chronic poisons. Arsenic sulfides are odorless, colored solids. They are nonvolatile and insoluble in water. Arsenic compounds are widely dispersed in the environment due to their use in pesticides and industry. The EPA has designated As_2S_2 and As_2S_3 as hazardous substances, priority toxic pollutants, and carcinogens.

Assumptions: Arsenic sulfides might have been used as pesticides at the site. Arsenic sulfides are thermodynamically unstable in the presence of oxygen and will gradually react (the sulfur species oxidizes) to form other arsenic compounds. The resultant arsenic oxidation products may persist on the site in the soil.

Pathways: Arsenic sulfides are highly insoluble and as such are immobile. However, the arsenic oxides that might be produced by long-term oxidation are more soluble and might contaminate groundwater. People and wildlife also could be exposed through inhaled dust. Toxic fumes could be generated if arsenic sulfide fumes are exposed to fire.

Fates: Although arsenic sulfides are unstable, available references are not specific on their reaction rates or products. It is likely that as the sulfides are oxidized, arsenic oxides would be produced. Regardless, the arsenic species would persist. Some might move into groundwater. Arsenic accumulates in the body.

Receptors: Primary receptors would be workers on the site or persons exposed to contaminated dust. Arsenic-containing dust can be inhaled or ingested. In general, toxic effects are more chronic than acute, although absorption of a large quantity of arsenic could cause acute poisoning. Repeated inhalation causes respiratory irritation. Ingestion causes weakness, appetite loss, gastric disturbances, neuritis, and hepatitis. Long-term effects of arsenic poisoning are fatal. Arsenic is a carcinogen.

Summary: Arsenic sulfides (or the sulfide reactant products) could persist in the soil. The greatest hazard from arsenic would appear to be inhalation of arsenic-contaminated dust, but unless the material is inhaled or ingested repeatedly or in large amounts, arsenic toxicity would not normally be severe.

CONTAMINANT: Asbestos

General: Asbestos is a generic term that defines a class of naturally-occurring hydrated mineral silicates that form fine filaments. Because of its fireproofing property, asbestos was widely used in the construction industry as an insulating material and as a component of roofing felts, floor tiles, and similar materials. Asbestos is now known to be a carcinogen and has been designated a hazardous waste and a priority toxic pollutant.

Assumptions: Asbestos was probably used in building materials on the site, and could be present in the walls, ceilings, and floors of existing structures. It also could have been stored or warehoused on the site.

Pathways: Asbestos is incombustible and insoluble. In its friable or powdery form, it can be dispersed in the air or in ventilating systems. Although asbestos can also be transported in water as suspended particulate matter, airborne dispersal of particulates is the primary means by which asbestos moves in the environment.

Fates: Asbestos, a mineral, is stable in the environment. It does not decompose or detoxify. The friable form of asbestos is a long-term health hazard.

Receptors: Asbestos causes lung cancer and asbestosis in humans. There are no other obvious symptoms, which makes asbestos poisoning particularly insidious. Inhalation of airborne particulates is the primary mode of asbestos entry. Health effects of ingesting asbestos particles (as in drinking water) are not fully documented.

Summary: Asbestos is a long-term and serious health threat. The primary hazard of asbestos is its ability to cause lung cancer in humans. References report that there is no evidence for a "safe" level of exposure to asbestos.

CONTAMINANT: Benzene (C_6H_6)

General: Benzene is a common industrial solvent with an aromatic odor. It is highly flammable and is very slightly soluble in water. It floats on water and freezes at 42°F. It is a volatile liquid and highly toxic. Benzene is a carcinogen and is a designated hazardous waste, hazardous substance, and priority toxic pollutant.

Assumptions: Benzene could have been used as an industrial solvent on the site. Benzene also is a component of unleaded gasoline. Spillage may have occurred. If benzene were stored or used on the site, it would persist only in sealed containers.

Pathways: As a liquid, benzene would flow into soil and groundwater. It is soluble enough to contaminate groundwater to unacceptable levels and volatile enough to be dispersed in the atmosphere. It would not persist on the site if spilled.

Fates: Benzene is relatively stable in the environment. It reacts quickly only with very strong oxidizing agents such as chlorine gas. Under normal environmental conditions, it would eventually decompose.

Receptors: The primary receptors would be workers on the site. Benzene is highly toxic, and it is an irritant. Inhalation produces dizziness, headache, respiratory symptoms, and loss of consciousness. Benzene attacks the liver and metabolizes to a phenolic compound that alters DNA in bone marrow. It is a carcinogen. It is toxic to aquatic wildlife in very low concentrations. Prolonged skin contact can cause blisters.

Summary: Benzene is unlikely to persist at the site unless it is stored in sealed containers. Spilled benzene would either volatilize or move quickly through soil to groundwater, where it would cause serious contamination. The greatest benzene hazard is as a carcinogen.

CONTAMINANT: Cadmium Oxide (CdO)

General: Cadmium oxide is a nonflammable solid. As a "fume" or dust, it is an extremely poisonous material. CdO is a carcinogen and an EPA priority toxic pollutant. The toxic component is the cadmium ion.

Assumptions: Cadmium oxide may have had industrial applications. If spilled or deposited on the site, CdO may still persist.

Pathways: Cadmium oxide is insoluble in water. Its primary pathways are inhalation of dust and ingestion of dust or contaminated food. Cadmium is concentrated and accumulated by marine organisms, especially shellfish. Toxic fumes may form if CdO is exposed to fire.

Fates: Cadmium is a toxic metal that is normally present in low concentrations in the environment. It reacts with strong oxidizers to form CdO, and with elemental sulfur and selenium to form relatively immobile compounds. Cadmium does not detoxify, however, and will persist indefinitely.

Receptors: The primary receptors would be workers on the site. A single exposure to CdO can cause lung injuries. Chronic exposure at low levels causes emphysema and kidney dysfunction. Ingestion is severely toxic and causes kidney and liver damage. Marine organisms concentrate and are poisoned by cadmium, which can be passed up the food chain.

Summary: CdO is an poisonous substance that can persist indefinitely. If spilled on the site in the past, it would probably still be there and should be treated with care. The greatest hazard from CdO on the site would be inhalation of contaminated dust.

CONTAMINANT: Calcium Oxide (CaO)

General: Calcium oxide is an odorless, nonflammable white or light gray solid. It reacts violently with water to form $Ca(OH)_2$, an alkaline substance.

Assumptions: Calcium oxide is a common industrial chemical. It could persist on the site only in sealed containers.

Pathways: Calcium oxide decomposes on contact with water to form the mildly caustic calcium hydroxide, a nonhazardous material. The reaction product, calcium hydroxide, is moderately soluble in water. Breached containers of calcium oxide could release CaO dust that would be a strong irritant to eyes and mucous membranes. This is the only route of entry to receptors.

Fates: Calcium oxide is unstable in the presence of water and rapidly decomposes with the liberation of heat. The reaction product, calcium hydroxide, is relatively innocuous. The heat produced from the reaction may be a hazard to personnel or other materials.

Receptors: The primary receptors would be workers on the site. CaO dust is irritating to the nose, eyes, and throat. The solid may burn skin on prolonged contact. The irritant action is due to its alkalinity and its exothermic (heat-producing) reaction with water. CaO is harmful to aquatic life in low concentrations because of the alkaline reaction product.

Summary: Calcium oxide does not persist in the environment. Uncontained CaO would not be found at the site. The primary hazard of this material would be due to its reaction with water in mucous membranes.

CONTAMINANT: Chromium Trioxide (Chromic Anhydride; CrO_3)

General: Chromium trioxide is a dark red powder. It is a powerful oxidizing agent and has been designated hazardous by the EPA. It is noncarcinogenic.

Assumptions: Chromium trioxide may have had industrial applications at the site. Because its water solubility and strong oxidizing properties, unsealed CrO_3 would not likely persist as such in the site environment.

Pathways: Chromium trioxide is highly soluble in water and is therefore mobile in an aqueous environment. It might also be spread as dust and inhaled or ingested.

Fates: Chromium trioxide dissolves in water to form the highly reactive oxidizing agent, chromic acid. This compound reacts with organic matter and all other reducing agents such as paper, wood, plastics, and similar materials. It reduces to lower oxidation states, which then persist in less toxic forms.

Receptors: Primary receptors would be workers on the site and those persons exposed to contaminated groundwater, if any. CrO_3 dust will burn skin and eyes. It is very irritating to mucous membranes and the respiratory system because of its oxidant properties. Ingestion causes severe gastrointestinal symptoms. Chronic exposure can cause bronchitis and dermatitis. It is very harmful to aquatic wildlife in low concentrations.

Summary: Chromium trioxide does not persist because of its reactivity with organic matter. Its greatest hazard is due to its action on skin and mucous membranes as a powerful oxidizing agent.

CONTAMINANT: Copper Acetate ($Cu(C_2H_3O_2)_2$)

General: Cupric acetate is an odorless, blue-green solid. It is listed as a hazardous substance and a priority toxic pollutant by the EPA. The toxic component is the copper ion. Copper salts are used for insecticides, algicides, fungicides and antifouling coating.

Assumptions: This chemical may have been used as a wood preservative or for some industrial purpose. Copper acetate would be unlikely to persist on the site, but some form of copper might. Spilled material would be washed from the soil by precipitation, possibly contaminating groundwater. Material in sealed containers would be relatively harmless.

Pathways: Cupric acetate is soluble in water. However, it is not likely to be a potential groundwater pollutant because the cupric ion rapidly precipitates at neutral pH as copper carbonate. Although it is nonflammable, contact with fire may produce irritating, volatile vapors of acetic acid. The solid might also be spread as dust.

Fates: Cupric acetate itself is a stable salt. The toxic component, copper, is known to accumulate in shellfish and can be concentrated in the food chain. Copper ions are stable in solution only under acidic conditions and could be transported in groundwater only under conditions of low pH, or possibly in a reducing environment. Copper ultimately deposits in sediments as carbonates or oxides.

Receptors: Primary receptors would be workers on the site. Secondary receptors would be organisms exposed to contaminated waters. Cupric acetate dust would be irritating to the eyes, nose and throat. Ingestion produces salivation, bitter taste, vomiting, purging, gastric pain, diarrhea, and convulsions. Chronic exposure may damage lungs, skin, liver, and kidneys.

Summary: Copper salts are widely used poisons that are common in the environment. If present, copper is likely to persist at the site in insoluble forms. The greatest hazard from copper appears to be inhalation of contaminated dust.

CONTAMINANT: Copper Acetoarsenite ($3Cu(AsO_2)_2.Cu(C_2H_3O_2)_2$)

General: Cupric acetoarsenite is an odorless green powder. It is highly poisonous, as it contains both copper and arsenic. It is listed as a hazardous substance and a priority toxic pollutant by the EPA.

Assumptions: Cupric acetoarsenite may have been applied at the site as a pesticide or wood preservative. This chemical would persist on the site if spilled.

Pathways: Cupric acetoarsenite is only slightly soluble in water and not as mobile as cupric acetate. It has a small potential to pollute groundwater. Although not flammable, this substance will form poisonous oxides of arsenic if exposed to fire.

Fates: The toxic components of this compound -- copper and arsenic -- are stable and will persist in the environment. Copper salts are known to accumulate in shellfish and mobilize in the food chain, but it is not clear from available references if copper from cupric acetoarsenite is readily available to metabolic systems. Most copper salts ultimately deposit in sediments.

Receptors: Primary receptors would be workers on the site. Cupric acetoarsenite dust is poisonous. It irritates eyes, noise and throat. If swallowed, it will cause gastric disorders, cramps, tumors and nervous collapse. Arsenic is a carcinogen, and the effects of long-term exposure are severe.

Summary: Cupric acetoarsenite is a hazardous poison that should be avoided. Spilled material would persist. Material in sealed containers should be handled with due caution. The greatest hazard of cupric acetoarsenite is its toxicity if ingested or inhaled.

CONTAMINANT: Creosote (includes Coal Tar)

General: Creosote is a flammable, heavy, oily liquid with a characteristic sharp, aromatic odor. It is produced by destructive heating of coal tar and has a mixed chemical composition. It is used as a common wood preservative. It is a carcinogen and a hazardous waste.

Assumptions: Creosote was very likely applied to railroad ties, fences, and other structures on the site as a wood preservative. It is a long-lived material that would persist; this organic mixture is stable for decades in the environment.

Pathways: The primary pathway for creosote contamination would be direct skin contact. The material is generally insoluble and non-volatile, although some trace components of the organic mixture may be both soluble and volatile. It is combustible and produces a black, irritating smoke when burned. The smoke is toxic.

Fates: Creosote persists as a tarry preservative. Like all organic material, it is subject to a gradual oxidation in the environment, but its toxic properties make it resistant to biodegradation. It does react with strong oxidizing agents.

Receptors: Only workers on the site would be at risk from this material. Creosote is irritating to the skin and eyes. The vapor causes moderate irritation to the eyes and throat. Contact with the liquid can cause reddening and itching of skin, and severe burns to eyes. Prolonged skin contact can burn the skin. Ingestion could cause vomiting, salivation, respiratory difficulty, vertigo, and headache. The smoke may be a carcinogen.

Summary: Creosote is a carcinogen and hazardous waste that persists in the environment. However, it is not mobile and would not be particularly dangerous unless workers were subject to skin contact or inhalation of smoke from a creosote fire.

CONTAMINANT: 2,4-D (2,4-Dichlorophenoxyacetic Acid)

General: 2,4-D is an odorless white or tan solid. It is used as a herbicide for the control of broadleaf plants. It is poisonous and is listed as a hazardous substance and a hazardous waste by the EPA.

Assumptions; 2,4-D may have been used as a herbicide on the site. Residual 2,4-D could be found on the site as a soil contaminant or could be present in sealed containers. Commercial 2,4-D might possibly be contaminated with trace amounts of highly-toxic dioxins, which could be a by-product of the manufacturing process.

Pathways: The solubility of 2,4-D is not consistently defined in reference documents; it appears to be slightly soluble in water. It is a non-volatile compound, but could be present in contaminated dust. In a fire, 2,4-D decomposes to form toxic HCl and phosgene gases. Trace amounts of very toxic dioxins can also be generated by combustion of 2,4-D.

Fates: The long-term fate of 2,4-D in the environment is not clearly defined. It has been known to pollute ground water. It appears to be persistent but does not have the affinity for fat tissue exhibited by DDT and DDD. It is reported in good references that 2,4-D does not accumulate in the food chain. However, other evidence suggests that it actually can be taken up by biota. Incomplete data is available on its stability in the environment, but it is known that spilled 2,4-D can persist in water for four to five years. As with all organic compounds, it would ultimately decompose by microbial action, chemical redox processes, or photooxidation.

Receptors: The primary receptors would be workers on the site. Dust may irritate the eyes. Ingestion of 2,4-D causes gastrointestinal distress, diarrhea, central nervous system depression, and possible liver and kidney injury. This material is known to cause birth defects in laboratory animals.

Summary: 2,4-D is a poisonous herbicide whose environmental behavior is not as well defined as that of some other toxicants. It appears not to be concentrated in living tissue. Its main hazard is probably acute exposure, which would appear unlikely on the site.

CONTAMINANT: 2,4,5-T (Trichlorophenoxyacetic Acid)

General: 2,4,5-T is a white-to-tan odorless solid. It is used as a herbicide. This poisonous material is a suspected carcinogen, and has been designated by EPA as a hazardous substance and a hazardous waste.

Assumptions: Residual 2,4,5-T might still contaminate soil on the site if this herbicide was applied as a defoliant. Traces of the material may also remain if spills occurred. The herbicide may be present in sealed containers. Commercial 2,4,5-T may contain traces of highly-toxic dioxins, which can form as contaminants during the manufacturing process.

Pathways: 2,4,5-T is non-volatile and insoluble in water. The material appears to be relatively immobile in the environment. The occurrence of contaminated dust is possible. 2,4,5-T is combustible and emits toxic fumes of phosgene or HCl when burned. Trace amounts of very toxic dioxins also can be produced during combustion of 2,4,5-T.

Fates: Data on the long-term stability of this herbicide is not conclusive. As an organic material, it would be subject to natural oxidative processes. There is some evidence that it can accumulate in the food chain, as it has been implicated in birth defects, tumor growth, and fetal death.

Receptors: Primary receptors would be workers on the site. 2,4,5-T is poisonous if inhaled or ingested. In very low concentrations it is harmful to aquatic life. Inhalation of contaminated dust would cause fatigue, nausea, vomiting, convulsions, low blood pressure, and loss of consciousness. This material is harmful to eyes and is reported to be corrosive to metals.

Summary: 2,4,5-T is a poisonous chemical that should be avoided. Its greatest hazard appears to be its acute toxicity if ingested, but it is also implicated in cancer and birth defects.

CONTAMINANT: DDD [TDE] (2,2-bis(p-Chlorophenyl)-1,1-Dichloroethane)

General: DDD, also known as TDE, was a formerly used as an insecticide. It is a combustible white solid. It is a carcinogen and has been designated as a hazardous waste and priority toxic pollutant. This material, a metabolite of DDT, was banned by EPA from further use in 1971.

Assumptions: DDD may have been applied to the site as an insecticide. More likely, it could be present as a breakdown product of DDT. Like DDT, it would persist in the environment.

Pathways: See discussion for DDT, following.

Fates: See discussion for DDT.

Receptors: See discussion for DDT.

Summary: DDD is very similar to DDT in its properties and behavior. It differs structurally by a single chlorine atom. It is a hazardous material that should be handled with care. As with DDT, the primary hazard of DDD is chronic toxicity resulting from its bio-concentration in fatty tissue.

CONTAMINANT: DDT (Dichlorodiphenyltrichloroethane)

General: DDT is a broad-spectrum insecticide. It is a colorless, odorless, waxy solid. It was banned by the EPA in 1972. It is listed as a carcinogen, hazardous substance, hazardous waste and priority toxic pollutant.

Assumptions: DDT may have been used as an insecticide on the site. It could be present as a contaminant in soil. DDT could also be present in containers or as a spilled residue. It was often used as a powdery dust combined with talc or other inert substances.

Pathways: DDT and its metabolites are toxic poisons with long-term persistence in soil and water. DDT can be dispersed widely in the environment by runoff, erosion and blowing particulates. Pathways on the site would include inhalation or ingestion of DDT-contaminated dust. The pure chemical is non-volatile, insoluble in water, and stable. It is combustible and produces harmful HCl fumes when burned.

Fates: DDT persists for a long time (at least decades) in the environment. Its low solubility in water and high affinity for fat tissue results in concentrated accumulation of DDT in the body fats of humans and wildlife. It readily travels up the food chain. It can be broken down by oxidizing agents.

Receptors: Primary receptors are workers on the site. Secondary receptors would be animals and humans that might pick up the material in the food chain. Human exposure to DDT is primarily through ingestion of contaminated food. Exposure to contaminated dust on the site would irritate the skin and eyes. Ingestion causes tingling of the lips and tongue, headache, malaise, sore throat, fatigue, tremors, confusion, paralysis, and coma. DDT causes cancer and birth defects. It is hazardous to all wildlife at any concentration, and its effects are chronic.

Summary: DDT is an extremely hazardous material that should be avoided or handled with great care. Its primary hazard is its chronic toxicity resulting from its affinity for and persistence in living fat tissue.

CONTAMINANT: Diesel Fuel

General: Diesel fuel is a yellow-brown, oily liquid with a characteristic petroleum fuel odor. It is commonly used to power trucks and industrial machinery.

Assumptions: Diesel fuel may have been used, stored, or spilled at many locations on the site. It might remain in sealed drums or as a soil contaminant. It also may persist in sludge from underground storage tanks.

Pathways: Diesel fuel is a flammable liquid. It is relatively non-volatile and is insoluble in water. If spilled, it would seep slowly into the ground, but would be absorbed on soil particles and remain relatively contained near the site of the spill.

Fates: Diesel oil is relatively stable and will persist in the soil for years. It does not enter the food chain and is relatively non-hazardous to aquatic life unless spilled in large enough quantities to cause physical fouling.

Receptors: Primary receptors would be workers on the site. The liquid is irritating to the skin and eyes. If swallowed, it would increase the frequency of bowel movements. Vapor contact may cause smarting of the eyes.

Summary: Diesel fuel is a flammable liquid with relatively low toxicity and potential for hazardous action. Its greatest hazard appears to be its flammability.

CONTAMINANT: Gasoline

General: This is a highly flammable, mobile liquid with a characteristic odor. It is a water-insoluble mixture of hydrocarbons.

Assumptions: Like diesel fuel, gasoline would have been commonly used on the site. Gasoline would not persist unless it were contained in sealed drums. Gasoline used in past years may have contained lead additives -- see discussions of tetraethyl lead and tetramethyl lead for their properties. Unleaded high-test gasoline may contain benzene, another hazardous material discussed separately.

Pathways: Gasoline is highly volatile and would evaporate rapidly if spilled. Although gasoline is insoluble in water, large or repeated spills could flow through the soil and contaminate ground water.

Fates: Gasoline is somewhat stable in the environment. It does not react with water and other common materials, but is susceptible to biological decomposition and ultimately would oxidize if exposed to the atmosphere.

Receptors: The only receptors would be workers on the site. Gasoline vapor is irritating to the eyes, nose, and throat. Vapors have systemic effects on the central nervous system and can cause dizziness, confusion, and loss of consciousness. If swallowed, gasoline will cause nausea and vomiting. The hydrocarbons contained in gasoline are harmful to aquatic life in very low concentrations.

Summary: Gasoline or other short-chained hydrocarbons are not likely to be on the site unless present in sealed containers. These materials are volatile and mobile. The greatest gasoline hazard is its flammability.

CONTAMINANT: Lead

General: Lead is a silvery, odorless, non-volatile metal that is typically found as yellow, orange, or reddish oxides. It is a hazardous material because of its toxic properties.

Assumptions: Lead is widely used in industry. It could be dispersed throughout the site because of its former uses as a gasoline additive, an additive to paints, and many other applications. Lead is commonly found in hazardous concentrations in historic fill along the San Francisco waterfront.

Pathways: The solubility of lead in water is limited by the low solubilities of carbonates and oxides. The only pathways of lead migration that are of concern are movement of contaminated dust and transfer by organisms in the food chain.

Fates: Lead is a non-degradable and persistent material that would persist indefinitely in contaminated soil. Lead can be taken up and accumulated by organisms in the food chain, where it is a chronic poison.

Receptors: Primary receptors would be workers on the site, who might be exposed to lead in contaminated dust. If ingested, lead will cause intoxication, confusion, headaches, anxiety, insomnia, and gastrointestinal upsets, including loss of appetite. Lead is a chronic poison and accumulates in the body, especially in bone tissue. As it accumulates, its effects gradually grow more severe. Secondary receptors would include any organisms exposed to lead in the food chain.

Summary: Lead is a chronic poison that should be avoided. The greatest hazard of lead is chronic poisoning from repeated ingestion over time. Chronic buildup of lead in the environment is a serious problem.

CONTAMINANT: Magnesium

General: Magnesium is a silvery white metal with industrial applications. Magnesium salts are non-toxic. Elemental magnesium is highly reactive, and under the proper circumstances can cause fires or explosions.

Assumptions: Elemental magnesium is not likely to be found on the site. It would persist only in sealed containers.

Pathways: Magnesium dust is highly flammable and burns to form magnesium oxide, a harmless substance. The only pathway for magnesium interactions would be direct skin contact.

Fates: Powered magnesium metal reacts with water and dilute acids to form magnesium oxide and hydrogen, an explosive gas. Magnesium metal is not found naturally. Magnesium salts are abundant in the environment and are non-hazardous.

Receptors: The primary receptors are workers on the site who might handle containers of the material. Penetration of skin by fragments is likely to produce local irritation, blisters, and ulcers.

Summary: Magnesium is a reactive, unstable element that forms non-hazardous salts. The primary hazard of magnesium is its flammability and reactivity. There would be little danger to trained personnel.

CONTAMINANT: Mercury and Mercury Salts

General: Metallic mercury is a very dense, silvery, mobile, odorless liquid. It is non-flammable and is designated as a hazardous waste. Several mercury salts are hazardous substances and priority toxic pollutants.

Assumptions: Mercury or mercury salts may have had industrial applications at the site. Unconfined elemental mercury is mobile and unlikely to be found on the site. Mercury salts of concern include mercuric cyanide, mercuric nitrate, mercuric sulfate, mercuric thiocyanate, and mercurous nitrate, all of which have been designated as hazardous substances.

Pathways: Elemental mercury is insoluble, but as a liquid, mercury is highly mobile. It will evaporate very slowly if exposed to the atmosphere. Mercuric salts are soluble in water and would move into the groundwater system. These materials are stable and non-flammable. Inhalation of dust is a possible pathway of exposure. In anaerobic environments, very toxic methyl mercury can be formed.

Fates: All mercury-containing salts of concern are stable and will persist in the environment. Mercury tends to accumulate in food chains, where it concentrates in liver and kidneys.

Receptors: Primary receptors are workers on the site. Secondary receptors are humans and animals that may pick up the material in the food chain. Mercury poisoning is chronic. (Acute poisoning from mercury vapors is possible, but unlikely at the site.) Chronic exposure causes tremors, loss of appetite, nausea, diarrhea, kidney damage, and damage to the central nervous system, including anxiety, delirium, hallucinations, or manic depression. Mercury is harmful to aquatic life in very low concentrations.

Summary: Mercury salts are toxic materials that are relatively mobile and persistent in the environment. The primary hazard is chronic poisoning due to long-term build-up of mercury in the tissues.

CONTAMINANT: Nitric Acid (HNO_3)

General: Nitric acid is a common industrial and laboratory reagent. It is a watery liquid with a choking odor. It is a strong acid and oxidizing agent. Nitric acid is listed as a hazardous substance by the EPA.

Assumptions: Nitric acid may have had industrial applications at the site. It might be present in containers.

Pathways: Nitric acid is completely miscible with water. Although it does not burn, it gives off poisonous oxides of nitrogen when heated in fires. Nitric acid fumes may be detected over the cool liquid as well. Nitric acid is very mobile in the environment.

Fates: Nitric acid is a reactive, corrosive substance. It is neutralized by basic compounds, forming nitrate salts. Soluble nitrate salts are long-term health hazards in their own right. Nitric acid attacks nearly all organic materials, such as wood, paper, cloth, and human skin. It also attacks and corrodes most metals.

Receptors: Primary receptors would be workers on the site and those persons exposed to contaminated ground water. Nitric acid vapors burn the eyes, nose, and throat. Vapor

also causes lung damage. Nitric acid liquid causes severe burns to the eyes and skin on contact. Soluble nitrates are implicated in methemoglobinemia in infants and as carcinogen-producing reactants.

Summary: Nitric acid is a dangerous industrial chemical. It is a powerful acid and oxidizing agent. The primary hazard from nitric acid is its acute damage to skin and tissue from accidental physical contact.

CONTAMINANT: Pentachlorophenol (C_6Cl_5OH)

General: Pentachlorophenol is a white to light brown solid with a phenolic ("carbolic acid") odor. It is used as a fungicide, bactericide, and wood preservative. EPA has designated this poisonous compound as a hazardous substance, hazardous waste, and priority toxic pollutant.

Assumptions: Pentachlorophenol may have been used as a wood preservative at many locations on the site. It also could have been spilled or stored on the site.

Pathways: Pentachlorophenol is not ignitable, but will generate toxic HCl vapors when exposed to fire. Trace amounts of very toxic dioxins may also form during combustion of pentachlorophenol. Pentachlorophenol is slightly soluble and will leach very slowly into soil and water under natural environmental conditions. Its sodium salt is highly soluble but less toxic. Spilled materials might be spread as dust.

Fates: Pentachlorophenol is a relatively stable poison; its stability aids its success as a wood preservative. It is incompatible with strong oxidizing agents and will eventually oxidize. It does not concentrate or accumulate in the food chain.

Receptors: Primary receptors would be workers on the site. Inhaled dust would be irritating to the eyes, nose, and throat. If ingested, pentachlorophenol will cause loss of appetite, respiratory difficulty, sweating, weight loss, dizziness, vomiting, coma, and death. It attacks the cardiovascular system, liver, kidneys, respiratory system, and central nervous system. This material is poisonous to aquatic life in very low concentration.

Summary: Pentachlorophenol is a poisonous priority pollutant that should be treated with care. Its primary hazard is its acute toxicity, which can result in death.

CONTAMINANT: PCBs (Polychlorinated Biphenyls)

General: Polychlorinated biphenyls are a closely-related group of compounds that were widely used commercially as electrical insulators. PCBs are carcinogens and are listed by the EPA as hazardous materials, hazardous wastes, and priority toxic pollutants. Physical appearance ranges from an oily liquid to a white powder.

Assumptions: PCBs are likely to be on the site in electrical cables, electrical condensers, and electrical transformers. They might also have been trace contaminants in light oils that might have been spread as herbicides.

Pathways: PCBs are insoluble and non-volatile, but accumulate in the food chain. They are readily stored and transmitted in fatty tissues. PCBs are combustible and produce toxic gases when burned, including trace amounts of very highly toxic dioxins.

Fates: PCBs are of concern because of their toxicity, their widespread use and disposal in the environment, their long-term persistence, and their tendency to accumulate in food chains. PCB contamination is a threat to humans. PCBs will decompose in the presence of strong oxidizing agents.

Receptors: Primary receptors would be workers on the site. Secondary receptors would be animals and humans exposed to PCB in the food chain. PCBs are harmful to aquatic life in very low concentrations. PCB vapors cause severe irritation of the eyes and lungs, and can cause severe injuries even at low concentrations. Chronic exposure can cause acne, jaundice, vomiting, liver damage, and fatigue. PCBs damage fetuses, and can cause birth defects and stillbirths. They are carcinogens.

Summary: PCBs are extremely hazardous materials that persist in the environment. The greatest hazard from PCBs appears to be the long-term concentration in the food chain, which leads to chronic exposure.

CONTAMINANT: Selenium Dioxide (SeO_2)

General: Selenium dioxide is a poisonous white solid with a sour odor. Selenium compounds have been designated as hazardous wastes and priority toxic pollutants.

Assumptions: Selenium dioxide may have had industrial uses at the site. Selenium dioxide probably would not persist because of its water solubility, which would tend to disperse it in the environment. If present, it would be in sealed containers.

Pathways: Selenium dioxide is soluble in water and would move into the ground water if spilled on site. Contaminated dust would be another pathway of selenium mobility. If exposed to fire or high heat, selenium dioxide sublimes, forming a toxic vapor.

Fates: Selenium dioxide is very stable in the environment and will persist indefinitely. It does not detoxify, although biological action might convert it into other toxic selenium species. Selenium is known to accumulate and cause birth defects in aquatic wildlife.

Receptors: Primary receptors would be workers on the site, waterfowl, and other organisms exposed to contaminated water. Selenium in very low dissolved concentrations is highly toxic to aquatic life and waterfowl. Selenium dioxide dust is poisonous if inhaled, and the solid is poisonous if ingested. Symptoms of selenium poisoning include bronchial spasms, garlic breath, a sensation of asphyxiation, and pneumonia. Acute symptoms include chest pain, cough, coated tongue, gastric disorders, and nervousness. Damage to kidneys, blood, and liver can occur.

Summary: Selenium is a poisonous material that should not be allowed to enter the environment. Its greatest hazard is its severe and long-term toxicity to aquatic life and waterfowl. Selenium is persistent, and contamination is very difficult to reverse.

CONTAMINANT: Sulfuric Acid (H_2SO_4)

General: Sulfuric acid is a colorless, oily, odorless liquid used commonly in industry and laboratories. It is highly corrosive and is designated by EPA as a hazardous substance.

Assumptions: Sulfuric acid may have had industrial uses on the site. Any sulfuric acid remaining would be in sealed containers.

Pathways: Sulfuric acid is completely soluble in water and is therefore very mobile in the environment. Concentrated sulfuric acid mixes violently with water, producing large amounts of heat.

Fates: Sulfuric acid is a reactive, corrosive substance. It is neutralized by basic compounds, forming sulfate salts, which are generally harmless. Sulfuric acid attacks nearly all organic matter. Dilute sulfuric acid attacks metals, corroding them and releasing hydrogen.

Receptors: Primary receptors would be workers on the site. Sulfuric acid will burn skin and eyes severely. Ingestion would cause severe injury or death. The acid is highly corrosive to living tissue. Effects are acute; chronic exposure is not likely.

Summary: Sulfuric acid is an extremely reactive, corrosive liquid. Its effects are not subtle. The greatest hazard from sulfuric acid is acute damage to eyes, skin, or tissue from accidental contact.

CONTAMINANT: Tetraethyl Lead ($Pb(CH_2CH_3)_4$)

General: Tetraethyl lead is a colorless, oily liquid with a slight musty odor. It is listed as a hazardous substance and a hazardous waste.

Assumptions: Tetraethyl lead was widely used as an additive in gasoline. The additive, an anti-knock compound, was the basis of the term "ethyl," as applied to high-test gasoline. Tetraethyl lead could be a component of gasoline spills or could be stored on the site in sealed drums. If spilled, its lead breakdown products might contaminate the soil.

Pathways: Tetraethyl lead is insoluble in water. It is somewhat volatile, as it boils right at the boiling point of water. It is combustible and produces toxic gases when burned. Dust from contaminated soil is a possible means of transport.

Fates: Tetraethyl lead decomposes in the presence of strong oxidizing agents. It degrades in sunlight to form simpler organo-lead compounds, some of which smell like garlic. Tetraethyl lead gradually breaks down in the environment, but the lead breakdown products are persistent and widespread from their use in leaded gasolines.

Receptors: Primary receptors would be workers on the site. Tetraethyl lead vapors are poisonous. Symptoms include respiratory tract irritation and itching and burning of skin. If ingested, tetraethyl lead will cause intoxication, headache, anxiety, insomnia, and gastrointestinal symptoms. Lead is a chronic poison and accumulates in the body, especially in bone tissue.

Summary: Tetraethyl lead is a poisonous liquid that should be avoided. The greatest acute hazard from this chemical appears to be ingestion or inhalation of the vapor. Chronic build-up of lead in the environment also is a serious problem.

CONTAMINANT: Tetramethyl Lead ($Pb(CH_3)_4$)

General: Tetramethyl lead is a colorless, oily liquid with a fruity or musty odor. This is an antiknock compound (similar to tetraethyl lead) that was used in leaded gasoline. Although the chemical is poisonous, it is not a carcinogen and is not listed as hazardous.

Assumptions: Tetramethyl lead might be on site in sealed drums. If spilled, its lead breakdown products might contaminate the soil.

Pathways: Tetramethyl lead is not soluble in water. It is somewhat volatile as it boils just above the boiling point of water. The material is combustible and generates toxic gases when burned. Dust from contaminated soil is a possible means of transport.

Fates: Information on the persistence of this compound in the environment is not readily available. However, lead breakdown products would persist and are widespread in the environment from their use in leaded gasolines. The compound decomposes in the presence of oxidizing agents.

Receptors: Primary receptors would be workers on the site. The vapor is poisonous, as is the liquid if ingested. Symptoms include insomnia, bad dreams, restlessness, anxiety, nausea, delirium, mania, convulsions, coma, death. Tetramethyl lead is harmful to the eyes and skin, and might be absorbed through the skin. Lead is a chronic systemic program.

Summary: Tetramethyl lead is a poisonous chemical that should be avoided. While lead build-up in the environment is a concern, the greatest immediate hazard from this chemical appears to be ingestion or inhalation of the vapor or the liquid.

CONTAMINANT: Toluene ($C_6H_5CH_3$)

General: Toluene is a clear, colorless, noncorrosive organic liquid with a sweet, pleasant aroma. It is widely used in industry and laboratories. It is designated as a hazardous substance, hazardous waste, and a priority toxic pollutant by EPA.

Assumptions: Toluene may have had industrial applications at the site. Any toluene remaining would be in sealed containers. Exposure to levels of this chemical necessary to produce toxic effects would be primarily in occupational or solvent abuse situations.

Pathways: Toluene is insoluble in water. It is relatively volatile and will evaporate upon exposure to air. It is flammable and produces irritating vapors when burned.

Fates: Toluene will evaporate and is therefore relatively mobile. It is a stable compound but is subject to eventual oxidation. It is decomposed by strong chemical oxidants.

Receptors: Primary receptors would be workers on the site. Toluene vapors are irritating to eyes, nose, and throat. Inhalation would cause nausea, vomiting, headache, dizziness and unconsciousness. Prolonged skin contact will dry skin and cause dermatitis. Liquid contact will irritate eyes. Damage is not permanent, although liver and kidney damage could occur with ingestion.

Summary: Toluene is considered hazardous but is one of the lower risk chemicals potentially found on the site. Its greatest hazard would appear to be its flammability.

CONTAMINANT: Xylene ($C_6H_4(CH_3)_2$)

General: Xylene is a colorless, organic liquid with properties similar to those of toluene. Xylene has three closely-related isomers that are widely used in industry. The EPA has designated xylene as a hazardous waste and a hazardous substance.

Assumptions: Xylene would not persist at the site unless it were in sealed containers. Exposures to this chemical are unlikely to produce serious damage unless occupational or solvent abuse situations occur.

Pathways: Xylene is insoluble in water, but relatively volatile. It is flammable.

Fates: Xylene will slowly evaporate if exposed to the atmosphere. It is stable, but as a hydrocarbon compound, would be subject to oxidation. It is broken down by strong oxidizing agents.

Receptors: Primary receptors would be workers on the site. Xylene vapors are harmful to eyes, nose, and throat. Possible routes of entry are inhalation of vapors, ingestion, and skin contact. Vapors cause headache and dizziness, and ingestion could cause nausea, vomiting, cramps, and unconsciousness. Damage to kidneys and liver may occur.

Summary: Xylene is an industrial solvent with a relatively low hazard potential. Its greatest hazard would appear to be its flammability.

NOTES - Hazardous Wastes

/1/ Sources for this section are as follows:

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McKee, J.E. and H.W. Wolf, Water Quality Criteria, 2nd Edition, California State Water Quality Control Board, Publication No. 3-A, 1963.

National Institute for Occupational Safety and Health, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, U.S. Department of Health and Human Services, October 1985.

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Sax, N.I. and R.J. Lewis, Eds., Rapid Guide to Hazardous Chemicals in the Workplace, Van Nostrand Reinhold Co., Inc., New York, 1986.

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U.S. Coast Guard, Chemical Hazard Response Information System: Hazardous Chemical Data, Volume II, Commandant Instruction M.16465.12A, Department of Transportation, Washington D.C., 1984.

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APPENDIX M. SPORTS FACILITIES

INTRODUCTION

- After publication of the Mission Bay Draft EIR in August 1988, Mayor Art Agnos released an invitation for proposals for a stadium to be located on the block bounded by Second, Third and King Streets, and San Francisco Bay; and an indoor arena complex at Seventh and Townsend Streets. Additional cumulative impacts potentially associated with those two facilities were the subject of a supplement to the EIR, published in March 1989. The ballpark concept was subsequently defeated by San Francisco voters in November 1989.

- Neither of the facilities was included as a component in a development proposal for Mission Bay. However, the proposed arena site is located within the current Mission Bay Project Area boundaries; if an arena were approved, those boundaries would be modified to exclude the arena site.

- Because of the potential magnitude of activity that would be posed by these two developments and their close proximity to the Mission Bay Project Area, additional environmental evaluation was required to supplement the cumulative impact analysis presented in the Mission Bay Draft EIR. This was necessary to ensure that implications of the two facilities as they might affect surrounding areas, and city or regional systems, were adequately accounted for in the cumulative analyses. The focus of the supplemental environmental analysis (presented below) therefore does not address specific design or program details of the stadium or arena; those types of issues would be subject to separate environmental review if a detailed program were ultimately defined.

- To evaluate a scenario with adverse conditions that would be reasonably likely to occur, the primary stadium/arena analyses assumed the presence of the land use program described in EIR Alternative A in the Mission Bay Project Area. For purposes of the analysis, it was assumed that the Mission Bay S/LI/RD land uses at Seventh and Townsend Street in Alternative A would be consolidated with other S/LI/RD uses elsewhere in the Project Area to allow the proposed arena to occupy that corner.

- The stadium/arena facilities were assumed to be completed in 1995. In most cases when a time horizon is applicable, the analyses below evaluate cumulative impacts in year 2000, because there is an extensive body of information on cumulative impacts available for this timeframe. In a few instances where the stadium/arena would have identifiable impacts beyond 2000, they are discussed accordingly.

PROJECT DESCRIPTION

- Few details about the stadium/arena design, operation or programming were known at the time of the supplemental environmental analysis. However, general parameters are identified below for each of the facilities, which established the bases for the impact analyses presented herein.

THE STADIUM

- The stadium site is shown on Figure XIV.M.1. The site is in multiple ownership by the Port of San Francisco, the City and County of San Francisco, and the California State Department of Transportation (Caltrans). The proposed baseball facility, with a seating capacity of 45,000, would likely occupy most of the site, with a building height ranging between 100 and 150 feet. In addition, it is assumed there would be on-site parking with a capacity of about 1,500 vehicles.

Under major league standards, the general orientation of the field would locate the outfield closest to the bay (to the east), and the infield further inland (to the west). The line from the pitcher's mound to first base would be in an approximate north-to-south direction. The facility would be available for other events, such as concerts, as well as baseball. It would include outdoor lighting and sound systems, the characteristics of which have not yet been specified. It is assumed MUNI would provide Ballpark Express shuttle bus service for baseball games, similar to that currently provided to Candlestick Park, and that new direct or increased regional transit service for stadium/arena events would be provided by SamTrans, Golden Gate Transit and CalTrain.

- In addition to review and approval required by the City, the stadium project would depend on purchase of property from Caltrans and an amendment to the Rincon Point - South Beach Redevelopment Plan to allow Second Street south of King Street to be included as part of the stadium site. The redevelopment plan amendment would require approval by

MISSION BAY BOUNDARY

STADIUM / ARENA

SOUTH BEACH REDEVELOPMENT AREA BOUNDARY

DESIGNATED RESIDENTIAL SITE
G* – Alternate Light Industry
J** – with Neighborhood Commercial

MAJOR PARK (Site **M**)

NOTE: All blocks are lettered in accordance with the site labeling in the Redevelopment Plan.

Mission Bay

SOURCE: San Francisco Redevelopment Agency; and Environmental Science Associates, Inc.

• FIGURE XIV.M.1
LOCATION OF STADIUM AND ARENA AND SOUTH BEACH REDEVELOPMENT AREA DESIGNATED RESIDENTIAL SITES

- the Redevelopment Commission and the Board of Supervisors. The project also would be subject to approval by the Bay Conservation and Development Commission (BCDC) and the California State Lands Commission (SLC). BCDC has authority over lands that fall within 100 feet of the Bay shoreline. Any stadium design would be reviewed by BCDC for compliance with public access requirements set forth in its policy documents, the San Francisco Bay Plan, and the San Francisco Special Area Plan.

- As the ballpark might be constructed within the 100-foot zone of BCDC jurisdiction, any design for the ballpark would be subject to BCDC's waterfront planning policies addressing limitations on filling of the Bay, compatible land uses, heights of structures, and public access to the shoreline. In addition to BCDC height-limit review, the project as proposed would require a reclassification of the City's height-limit of 40 feet along the waterfront. These considerations would be included among the project-specific impacts subject to later environmental review if and when a detailed proposal and design for the ballpark is pursued.

  Pier 46B, located in the southern portion of the stadium site, is held in public trust by the Port of San Francisco. Disposition of Pier 46B for the construction of the stadium would be subject to review of the State Lands Commission to determine its compatibility with public trust restrictions. If the project does not meet those public trust requirements, the SLC would have the authority to transfer the public trust to other lands determined to be appropriate.

THE ARENA

- The arena site is owned by Santa Fe Pacific Realty Corporation. Currently, the Southern Pacific Transportation Company owns an easement on the property that is used to provide CalTrain service. The project proposed for this site would be an enclosed public arena with a seating capacity of 20,000. Its building envelope would likely range from 100 to 120 feet in height. It would be available for a variety of activities, including professional basketball or hockey league series or other sporting events, concerts, conventions, and other public events. It has been assumed the site would also provide on-site parking. Initially, 700 spaces would be provided on a surface lot contained on the site. It is assumed that at some time beyond 2000 (approximately 2005), additional parking would be needed. Approximately 2,500 spaces could be provided in a garage structure.

EVENT TIMES

The two facilities would accommodate various types of events on weekdays and weekends, during the day and evening. Two analyses have been prepared. Scenario One evaluates future conditions assuming a sell-out crowd at the stadium during a weekday afternoon; Scenario Two evaluates impacts associated with a weeknight sellout crowd at the stadium, and a 50%-capacity event at the arena. Many of the impact analyses herein are unaffected by the time of events. However, there are some, particularly the transportation analysis, where the impacts are closely associated with the two event scenarios analyzed. More discussion as to why these two scenarios have been selected for analysis is included in the Transportation section of this chapter, pp. XIV.M.11-XIV.M.12.

LAND USE, BUSINESS ACTIVITY, AND EMPLOYMENT

A direct effect of the construction of the arena on the Seventh/Townsend site would be the relocation of the S/LI/RD uses at that corner in Mission Bay Alternative A to other S/LI/RD sites in the Mission Bay Area. There would be enough undeveloped land at those alternate locations to permit such displacement without resulting in higher buildings there. That is, the relocation could be accommodated by an expansion of building footprints in the alternate S/LI/RD areas.

- Construction of the stadium would also have the direct impact of displacing existing commercial/industrial/office uses, in one- and two-story buildings that face on Berry Street between Second Street and Third Street. Those uses lie outside the Mission Bay Project Area. North of Berry Street, this action would displace an estimated 260 workers, including about 170 service/light-industry employees and about 90 office workers./1/ Some of the uses that would be displaced are maritime-related. The uses south of Berry Street along China Basin (Pier 46B) are mostly maritime-related; several active tugboats operate there. Employment is estimated at 40 persons./2/ The displacement of maritime-related activities is particularly notable because relocation opportunities, requiring close or direct access to the waterfront, would be limited in San Francisco.

- The I-280 Transfer Concept Program (TCP) would widen King Street to become King Boulevard by 1994. The King Street widening would remove an 80-to-90-foot-wide strip of land along King Street from the block bounded by King, Berry, Second, and Third Streets. This action would either displace uses that face on King Street or else reduce

- their property sizes by about one-third. Depending on building construction and conditions, this action could also weaken other structures within this block that face on Berry Street. This could displace those uses or require structural improvements to those buildings./3/ Those impacts would be due to the I-280 TCP, and not a result of the stadium project.

Less-direct effects of the arena and the stadium would result from the creation of a new type of land use in the Mission Bay / South of Market / South Beach Redevelopment areas. That use would introduce large numbers of people over concentrated time periods, either on weekday afternoons or evenings, or on weekend afternoons or evenings. The main impacts would be on nearby residential areas, existing and proposed.

- Existing residential developments in the South Beach Redevelopment Area and South Park are close to the proposed stadium site, as is the South Beach marina (see Figure XIV.M.1, p. XIV.M.3, for locations of South Beach blocks). The closest existing South Beach residential structure is the South Beach Marina Apartments (Site I-2), a four- to fourteen-story complex in the block bounded by Colin P. Kelly, Jr. Street, First Street, Brannan Street, and Townsend Street, about one block north of the stadium site. This complex contains 414 dwelling units (207 one-bedroom, 207 two-bedroom), about 80 of which are being rented at below-market rates. About 1-1/2 blocks north of the stadium site is the four-story Delancey Street multi-use project (Site J), on the Brannan/First/ Embarcadero triangle. This project is scheduled for completion in June 1990 /4/, and contains 177 dwelling units, as well as educational and commercial space. The existing South Park mixed-use neighborhood, containing about 140 dwelling units, and occupying the block bounded by Bryant, Brannan, Second, and Third Streets, also is located about 1-1/2 blocks away.

- In addition, there is the Bayside Village residential development (Site E), about two blocks north of the stadium site. The first two phases of this project were completed at the end of 1989; the third phase is scheduled for completion in mid-1990./4/ This project contains 868 dwelling units, including about 170 low-income units.

- Proposed residential developments in the South Beach Redevelopment Area include Redevelopment Sites K and L, both of which are in the Second/King/Embarcadero triangle, across Second Street from the proposed stadium site. Site K is proposed to contain 125 dwelling units (all rental), including about 60 low/moderate income units. Site L is proposed for development of 235 dwelling units (either condominium ownership

- or rental), including about 50 low/moderate income units. South Beach Redevelopment Sites G and I-1, about one block and two blocks north of the stadium site, respectively, are additionally designated for housing development; planning for those sites is in the early stages.

  The South Beach Redevelopment Area could be expanded in the future. The San Francisco Redevelopment Agency is working with appropriate City staff and citizen advisory groups, to look at other possible sites for housing outside of but close to this area./4/ Those discussions could lead to a formal proposal for Redevelopment Area expansion.

- In the Mission Bay Project Area in Alternative A, there would be residential areas along Fourth Street north of Mission Rock Street. They would be separated from the stadium by China Basin Channel, the China Basin Office Building, the Lefty O'Doul Bridge, and the proposed hotel along Third Street. There would also be Mission Bay residential development immediately north of the channel west of Fourth Street, which would be separated from the stadium by the China Basin Office Building. The proposed Mission Bay open space on the east side of Third Street would be directly across China Basin Channel from the stadium.

  Near the arena site, but east of the elevated I-280 freeway and south of China Basin Channel, are the existing (houseboat) and proposed residential areas within the western boundary of the Mission Bay Project Area. There would be additional Mission Bay residential development immediately north of the channel (east of Sixth Street), separated from the arena by the elevated I-280 freeway.

  In Alternative B, proposed residential uses extending from Third to Sixth Streets between Townsend and Berry Streets would be immediately across Third Street from the stadium, and would be separated from the arena by the elevated I-280 freeway. There would be more open space straddling Third Street immediately south of the channel, near the stadium. Alternative N industrial and commercial uses would be compatible with the stadium and the arena.

- Events at the stadium and the arena would introduce more intense activity into neighborhoods, particularly noticeable in the evening. The increased congestion and noise, from the stadium/arena sites themselves, and from added vehicles and pedestrians, would create an impact on present and future residents. Open space in Mission Bay and in

- South Beach could become an attractive area for pre-game recreation by ballgame patrons, especially on weekends, less so for weekday afternoon and weeknight games. At this time, it is not known exactly how many events would be scheduled for the two facilities. It is probable that the stadium would support at least 80 home baseball games, and the arena at least 40 home basketball games. In addition, other activities such as concerts or conventions may be scheduled at either facility.

  The arena would introduce additional year-round employees to the area. In a cumulative sense, the addition would be statistically insignificant when compared to the potential total Mission Bay area employment. Stadium employment would represent a shift from current Candlestick summertime employment (it is presumed that Candlestick Stadium would remain as a football stadium, so that it would not be redeveloped to a new employment-generating use). Therefore, the introduction of the stadium would not be expected to add to citywide or regional employment.

- Construction of the stadium/arena would add to citywide and regional employment on a temporary basis until 1995 during the planning, design and construction of the sports complex.

  The presence of stadium/arena events could have some growth-inducing impacts. Stadium/arena activities could generate additional demand for commercial goods and services that cater to event attendees. At this time when no detailed event programming has been established for the stadium or arena, it is not possible to indicate the extent of this possible impact. Demand for such commercial activities possibly could be accommodated in building space in the Mission Bay Project Area.

  Development of the stadium, along China Basin and the Bay, would add to the displacement of maritime-related operations caused by the Mission Bay development in Alternative A. Mitigation measures could include relocation assistance for displaced business operations, particularly maritime-related activities. Development of the stadium on its waterfront site could require approvals, including amendments of existing Plans, by BCDC and the Port Commission.

  Mitigation for the other land-use incompatibility impacts is described in the specific impact categories following.

TRANSPORTATION

BACKGROUND

- Transportation impacts analyses for the stadium/arena use Alternative A in year 2000 as a primary data base. The Alternative A analyses provide the most reliable context for future conditions without a stadium/arena, and thus a base against which the additional effects of the stadium/arena facilities are analyzed. For a full presentation of transportation impacts of Alternative A (as well as the two other EIR Alternatives), see VI.E. Transportation, pp. VI.E.50-VI.E.197.

  In some cases, impacts of the stadium/arena would not be fully exhibited until all development in Mission Bay is completed (around year 2020). Where applicable and appropriate, those effects also have been evaluated in this supplemental analysis.

- The projection of stadium/arena impacts assumes the same transportation network is in place as evaluated in the analyses for the Mission Bay EIR Alternatives summarized here. It is assumed that the CalTrain station would be relocated to an interim station around Seventh and Channel Streets. Construction of roadway and transit improvements as part of the I-280 Transfer Concept Program would be completed: extension of MUNI Metro south of Market Street along King Street to meet the CalTrain station; roadway widening to accommodate MUNI Metro and pedestrian improvements along The Embarcadero; roadway widening to accommodate MUNI Metro and additional vehicle lanes on King Street; and replacement of the existing off-ramp from I-280 at Fourth and Berry Streets with two ramps (one on, one off) accessing I-280 from King Street near Sixth Street.

  In addition to the introduction of MUNI Metro service to the area, there would be extensions of MUNI surface street routes to or through Mission Bay that would also accommodate visitors to stadium/arena events. These lines, such as the 30-STOCKTON and 15-THIRD, also would provide connections to Market Street and other parts of the central downtown area. Furthermore, it is assumed MUNI would provide Ballpark Express shuttle bus service similar to that currently provided to Candlestick Park.

  Some off-street parking would be provided at each of the two facilities. About 3,000 spaces would be adjacent to the stadium and about 2,000 next to the arena, in multi-floor parking structures.

TRAVEL CHARACTERISTICS

Travel characteristics of visitors to the stadium/arena are based primarily on survey data collected at two separate times at Candlestick Park, and theoretical analyses presented in the 1983 Stadium Feasibility Analysis report published by the City. These sources provided base trip distribution, modal split and vehicle occupancy factors; they were then modified slightly for use in this analysis to account for the downtown location of the proposed stadium/arena facilities. Tables XIV.M.1 and XIV.M.2 present the numerical factors used in this analysis.

On the basis of greatly improved access to public transit and fewer parking resources, the stadium/arena would likely generate a higher use of transit than occurs at Candlestick Park during weekdays. However, during nighttime events at the proposed stadium/arena, there would be adequate parking that would preclude the need for a very high use of

TABLE XIV.M.1: TRIP DISTRIBUTION FACTORS FOR THE STADIUM/ARENA ANALYSES

Area	Candlestick Park 1981 Survey/a/	Candlestick Park 1988 Survey/b/	Downtown Location Projected in 1983 Report/c/	Downtown Location Used in This Study/d/
San Francisco (Includes So. Cal./Out of State)	33.8%	34.0%	38.0%	38.0%
South Bay (Includes Monterey/Santa Cruz)	43.0%	36.0%	36.0%	36.0%
East Bay (Includes Sacramento/Stockton)	11.6%	20.0%	13.0%	16.0%
North Bay	11.6%	10.0%	13.0%	10.0%

/a/ City and County of San Francisco, Department of Public Works, Traffic Division, Report on Candlestick Park Access, 1981.
/b/ Parallax Marketing Research, Inc., Giants Magazine Study, 1988.
/c/ City and County of San Francisco, Stadium Feasibility Analysis, Vol. I, Research and Data, 1983.
/d/ Robert L. Harrison.

SOURCES: Robert L. Harrison and Department of City Planning

TABLE XIV.M.2: MODAL SPLIT FACTORS FOR THE STADIUM/ARENA ANALYSES

Scenario	Mode	Candlestick Park 1981 Survey	Candlestick Park 1988 Survey	Downtown Location Factors Used in This Study
Weekday 3:00-4:00 p.m. (Scenario One, Stadium Sellout)	Auto	81.0%	85.0%	59.0% /a,b/
	Public Transit	14.0%	5.0%	26.0%
	Other/c/	5.0%	10.0%	15.0%
Weeknight 6:30-7:30 p.m. (Scenario Two, Baseball Sellout and 50% Arena Use)	Auto	87.0%	89.0%	80.0% /a,b/
	Public Transit	9.0%	NA	13.0%
	Other/c/	4.0%	11.0%	7.0%

NA - Not available.

/a/ An average vehicle occupancy of 2.75 persons per vehicle is used in the analysis. This is the lowest occupancy rate observed in earlier surveys.
/b/ The main determinant of the auto mode share is the supply of available parking. With substantially more limited parking resources available on weekday afternoons, levels of auto use would be lower than levels of auto use during weeknights.
/c/ Other modes include charter bus, walking, and taxi.

SOURCE: Department of City Planning

transit at that time. While current City policy is to develop programs which promote transit use wherever possible, the assumptions used in this analysis are based on only moderate use of transit to those games when parking is available. This approach is used in order to ensure that the impacts of auto use are not understated. In this analysis, auto use is assumed to be 80% of total person trips to night events. For stadium sellout weekday events, when parking is limited, auto use would have to be reduced to about 59% of total trips in order for parking supply to accommodate parking demand.

EVENT TIMES

As previously stated, this analysis is based on two event scenarios at the stadium/arena. They were selected for purposes of evaluating their implications for peak period travel conditions which occur during the weekday afternoon commute. While it is recognized

that events at the stadium/arena also would generate transportation impacts on weeknights and weekends, the intent of the analysis is to examine those travel impacts when background conditions are typically most adverse.

Scenario One assumes a sellout baseball game (45,000 attending) at the stadium during a weekday afternoon. With an assumed game time of 12:00 noon, the game would end about 3:00 p.m., with the majority of departing fans entering the transportation system between 3:00 and 4:00 p.m. Scenario Two assumes a nighttime sellout crowd (45,000) at the stadium and a 50% capacity event (10,000 attending) at the arena. Those events are assumed to begin at 7:30 p.m., with most patrons arriving between 6:30 and 7:30.

- The attendance figures represented in these event scenarios are conservatively high for the purposes of conducting a reasonably high-end impact analysis. Past records for Candlestick Park indicate that sellout crowds are not typical in San Francisco. During the 1988 season, which yielded one of the highest attendance records for Candlestick, the single sellout game of 54,500 occurred on opening day; beyond that, there were only three other games of the 79 home games that exceeded an attendance of 45,000. Average attendance at all weekday or weeknight games last season was between 18,000 and 19,000. Of the 79 home games, 54 occurred on weekdays during the 1988 season. Of those 54, 12 occurred during the afternoon, while the rest occurred during the evening. Thus, sellout games on weekday afternoons are not likely to be a common occurrence.

  In light of those statistics, the attendance figures assumed in this analysis incorporate a substantial overestimate of impacts. To the extent other combinations of activities could be scheduled between the stadium and arena facilities that have overlapping effects with the afternoon commute, it is likely the impacts analysis presented here would account for them, though in indirect terms. Thus, for example, it is quite possible the arena with its 20,000 seats would hold sellout events. However, it is not likely to occur concurrently with a stadium sellout. Given that the analyses evaluate event scenarios with an attendance range of 45,000 to 55,000, either would cover the effects of an arena sellout.

- Weekday and weeknight ballpark/arena events would potentially attract a large number of people already in the downtown. Thus, when this occurs, ballpark/arena trips made by downtown attendees would either replace what would otherwise be standard commute trips out of the downtown (following an afternoon game), or be deferred until after the commute period (following an evening game or event). The degree to which this would occur with the proposed ballpark/arena facilities cannot be estimated at this time, and

- there is therefore no accounting for this factor in the transportation analyses. Thus, the analyses presented below, which assume all ballpark/arena travel would be a net new component of trips on top of projected commute conditions, represent another conservative assumption which double-counts some unquantifiable portion of trips in this cumulative analysis.

- It is important to note that contributions to cumulative impacts generated by a sellout event at the downtown ballpark would likely be substantially less than those generated by a sellout game at Candlestick Park. Due to the smaller capacity of the proposed downtown ballpark, better access to the regional freeway network, and greater availability of public transit options, the cumulative impacts presented herein would be less intense than those associated with Candlestick.

The analysis presented below is not intended to imply that impacts from the stadium/arena would coincide exactly with 4:00 to 6:00 p.m. peak period commute conditions analyzed in VI.E. Transportation. However, as discussed in VI.E. Transportation, pp. VI.E.85-VI.E.92, by year 2000, increased traffic will have expanded the duration of congestion on weekday afternoons. For this reason, the analysis addresses a slightly broader period of time, from about 3:00 to 7:00 p.m., to analyze additional stadium/arena effects relative to the analyses in VI.E. Transportation.

TRIP GENERATION

Based on the travel characteristic assumptions stated above, the number of stadium/arena trips affecting the afternoon commute is presented in Table XIV.M.3 for each scenario. That trip generation table identifies trips by vehicle, transit and "other" modes of transportation (e.g., walking, charter bus), distributed to each major geographic corridor.

YEAR 2000 IMPACTS

Impacts at Cumulative Screenlines/5/

- To the extent stadium/arena activities would worsen impacts at cumulative screenlines beyond levels already evaluated in VI.E. Transportation, pp. VI.E.84-VI.E.104, the trips would have to be leaving San Francisco. For inbound travel on transit carriers flowing opposite to the peak travel direction, adequate transportation capacity generally is

TABLE XIV.M.3: VEHICLE, TRANSIT, AND OTHER TRIP GENERATION, 2000

Scenario	Mode	San Francisco	South Bay	East Bay	North Bay	Total
Weekday 3:00-4:00 p.m. (Scenario One, Stadium Sellout)/b/	Vehicle	1,740	4,290	1,860	1,220	9,110
	Public Transit	7,660	1,810	940	340	10,750
	Other/a/	3,510	1,510	670	500	6,190
Weeknight 6:30-7:30 p.m. (Scenario Two, Stadium Sellout and 50% Arena Use)/c/	Vehicle	4,670	6,060	2,660	1,700	15,090
	Public Transit	4,940	1,120	580	210	6,850
	Other/a/	1,980	940	420	310	3,650

/a/ Trips made by walking, taxi, charter buses, and modes other than vehicle or public transit.
/b/ These trips, resulting from visitors exiting the stadium between 3:00 and 4:00 p.m., would be outbound trips.
/c/ These trips, resulting from visitors arriving between 6:30 and 7:30 p.m. for evening events, would be inbound trips.

SOURCE: Robert L. Harrison

available to accommodate travel demand. Inbound travel to San Francisco via freeways, however, would incrementally contribute to already congested conditions projected to be generated primarily by outbound freeway trips. Inbound trips to downtown San Francisco, however, do not constitute the major component of travel during the afternoon peak period.

This point is important to understand because the trips generated by attendees in Scenario One would be outbound trips that would contribute to more congested conditions on the highways. Inbound trips by attendees arriving for evening events, as assumed in Scenario Two, would not worsen projected adverse cumulative impacts on regional transit carriers. However, inbound trips arriving in downtown San Francisco between 6:30 and 7:30 p.m. via freeways would still contribute incrementally to projected freeway delays. Those nighttime trips, however, would generate traffic and parking impacts in areas surrounding the stadium/arena sites that are additional to those evaluated in VI.E. Transportation, pp. VI.E.140-VI.E.148 and pp. VI.E.158-VI.E.164. Those impacts are described below under "Local Intersection Impacts" and "Parking Impacts."

Regional Highway Impacts

Table XIV.M.4 provides a comparison of how cumulative travel demand at the regional screenlines would be further affected by either of the two stadium/arena scenarios in year 2000. For the East Bay and North Bay in particular, the additional number of vehicles generated under Scenario One would contribute to already congested conditions projected in that year. Travel demand from the stadium would occur when there is virtually no available capacity on the Golden Gate and Bay Bridges. Although the additional trips generated by the stadium sellout would load onto freeways between 3:00 and 4:00 p.m., before the 4:00 to 6:00 p.m. peak period, they would further contribute to expanded congestion periods already projected in VI.E. Transportation, pp. VI.E.85–VI.E.91, for the Golden Gate and Bay Bridges. That is, the total period of time these bridges would carry full capacity would be longer. For the Golden Gate Bridge, congestion could be increased to a total of about three hours; for the Bay Bridge, the congestion period could extend for a total of about five hours.

TABLE XIV.M.4: TRIPS AT REGIONAL HIGHWAY SCREENLINES BETWEEN 3:00 AND 7:00 P.M., 2000•

		Without Stadium/Arena		With Stadium/Arena/a/	
Screenline/Facility	Capacity at 3:00–7:00 p.m.	Demand	Approx. No. of Hours of Congestion	Demand	Approx. No. of Hours of Congestion
North Bay/ Golden Gate Bridge	28,800	27,200	2	28,420	3+
East Bay/San Francisco–Oakland Bay Bridge	38,800	42,850	4.5	44,710	5±
South Bay/U.S. 101 (at County Line)	32,000	30,875	3	30,875 to 35,165	3–4+
South Bay/I-280 (at County Line)	32,000	22,425	less than 1	22,425 to 26,715	2+

/a/ For weekday afternoon sellout event at the stadium.

SOURCE: Department of City Planning

As indicated in Table XIV.M.4, stadium/arena activities also would affect U.S. 101 and I-280 serving the South Bay (Peninsula). Analyses in VI.E. Transportation, pp. VI.E.91-VI.E.92, for year 2000 project congestion levels at the cumulative screenline for U.S.101 that would probably extend beyond the 4:00-6:00 p.m. peak period into a third hour, without additional stadium/arena traffic. I-280, on the other hand, is projected to still have available peak-period capacity in year 2000 (without new stadium/arena traffic).

At this time, it is not possible to project accurately how many trips to the South Bay, following an afternoon baseball game, would travel via U.S.101 vs. I-280. Congestion levels on U.S. 101 could last for three to over four hours, depending on how many stadium trips were added to peak afternoon commute travel. Congestion on I-280 could extend beyond the peak two hour (4:00-6:00 p.m.) congestion period. If new stadium/arena trips were split evenly between the two freeways, congestion on U.S. 101 could extend for a total of about 3.5 to 4 hours, while I-280 would be approaching a total two-hour congestion period. As noted earlier, these conditions do not take into account offsetting impacts of trips being generated at the downtown stadium location versus those that otherwise would be generated by a sellout game at Candlestick Park.

In light of the ease of access to I-280 by stadium/arena visitors (via on-ramps at Sixth and King Streets and at Mariposa Street), and higher congestion levels projected for U.S. 101, the quickest route to leave the stadium/arena is likely to be via I-280. Travel flow on both freeways would continue to be constricted at their interchange near Alemany Boulevard, north of both of the freeway screenlines. This could result in some drivers diverting trips onto local streets and returning to the freeway south of the interchange to circumvent those congested conditions.

Public Transit Impacts

Projections of public transit use are predicated on the provision of new or increased service to the stadium/arena by MUNI, Golden Gate Transit, SamTrans and CalTrain. Table XIV.M.5 shows the number of new trips projected for each regional transit carrier associated with the two stadium/arena scenarios analyzed.

The greatest transit system impacts would occur under Scenario One, when fans depart the soldout ballgame. As noted above, all weekday ballgames would begin at noon and end at about 3:00 p.m. This means that transit system operators would have to have their equipment available from 3:00 to 4:00 p.m. in order to serve the stadium crowd.

TABLE XIV.M.5: TRANSIT PATRONAGE AND EQUIPMENT REQUIREMENTS, STADIUM AND ARENA, 2000•

Scenario	Patronage and Equipment	Transit System					
		MUNI Railway	CalTrain	BART	SamTrans	AC Transit	Golden Gate Transit
Weekday 3:00–4:00 p.m. (Scenario One, Stadium Sellout)	Patronage	7,660	900	470	910	470	340
	Buses	68	–	–	20	10	7
	Railcars	29	7	7	–	–	–
Weeknight 6:30–7:30 p.m. (Scenario Two, Stadium Sellout and 50% Arena Use)	Patronage	4,940	560	290	560	290	210
	Buses	44	–	–	12	6	5
	Railcars	19	4	4	–	–	–

SOURCE: Robert L. Harrison

Following the ballpark service, most operators would need to commit their entire transit fleet to the normal afternoon peak commute period. If ballgames ended much after 3:00 p.m., public transit systems would have a difficult task in servicing both the stadium and normal commute travel demand. This service planning issue would not be unique to the proposed stadium; it would be applicable for wherever a stadium is located in San Francisco.

MUNI would experience the greatest impact of the transit systems that serve the stadium/arena. MUNI would need to operate "Ballpark Specials" on several surface routes, similar to the type of service currently provided to Candlestick Park. This bus service would be in addition to other permanent planned MUNI surface routes and the extension of MUNI Metro light rail service into Mission Bay. Among these various types of services, Scenario One would require the equivalent amount of personnel and service provided by about 68 buses and 29 Metro railcars.

Service needs are expressed in terms of equivalent transit vehicles, because it cannot be determined at this time how MUNI or other transit providers would choose to deploy pre-peak-period service in 2000. It is possible some demand could be accommodated

on regularly scheduled service at that time, in which case the equipment requirement estimates in Table XIV.M.5 would be overestimates of need.

The transportation analyses in VI.E. Transportation forecast full utilization of the peak-period (4:00-6:00 p.m.) Golden Gate Transit, BART-East Bay and AC Transit service available in year 2000 to carry commuters from the Downtown & Vicinity. With the additional number of trips generated under Scenario One, Table XIV.M.5 provides the estimated additional transit vehicles needed by each carrier to provide the increased passenger capacity for new trips generated under Scenario One.

Table XIV.M.5 also estimates the additional number of vehicles needed to meet stadium/arena demand on South Bay Peninsula transit service providers. Unlike its forecasts for future transit service to the East Bay and North Bay, VI.E. Transportation, pp. VI.E.101-VI.E.103, forecasts unused capacity on Caltrain, SamTrans and South Bay BART during the peak period. In light of that, there may be more ability for these agencies to accommodate pre-peak stadium/arena trips than is indicated by the estimated equipment requirements.

Substantially less public transit service would be needed to transport visitors to the nighttime events assumed in Scenario Two. As discussed above, fewer people are assumed to take transit to the stadium/arena at night, when more parking is available. In addition, arrivals to the stadium/arena facilities would be inbound trips, for which there would generally be greater transit capacity than for outbound trips. It is therefore less likely that the transit vehicle requirements shown in Table XIV.M.5 would represent a need for that amount of net new service; it is possible much of this demand could be accommodated by regularly scheduled service.

Impacts on the Local Transportation System

Parking impacts are determined by the number of vehicle trips generated by the two stadium/arena scenarios analyzed, as presented in Table XIV.M.3, pp. XIV.M.14. By the same token, the available supply of parking would affect the number of vehicle trips that would occur. Thus, as previously discussed, the area around the stadium/arena would accommodate fewer cars during a weekday than during a weeknight or weekend, because most of the parking supply would be occupied by downtown workers. The traffic analysis for local intersections below accounts for the different supply of available parking between the two scenarios evaluated.

Local Intersection Impacts

Vehicle trips to and from each part of the Bay Area have been assigned to the most logical city street and freeway routes leading to the parking areas for the stadium/arena. Each trip path has been traced through the street network, so that traffic movements at each intersection studied can be determined and recorded. At each intersection, the trips associated with the stadium/arena, combined with all other traffic projected to occur in 2000, are the basis for the Level of Service calculations presented in Table XIV.M.6.

TABLE XIV.M.6: INTERSECTION LEVELS OF SERVICE (LOS) AND VOLUME-TO-CAPACITY (V/C) RATIOS, STADIUM AND ARENA, 2000

	4:30 to 5:30 p.m. Future Conditions Without Stadium/Arena		3:00 to 4:00 p.m. Scenario One – Weekday Stadium Sellout		6:30 to 7:30 p.m. Scenario Two – Weeknight Stadium Sellout and 50% Arena Use	
Intersection	LOS	V/C	LOS	V/C	LOS	V/C
Third/King	D	0.89	E	0.92	F	1.49
Third/Townsend	A	0.57	E	0.98	E	0.94
Third/Mariposa	C	0.78	C	0.79	F	1.02
Seventh/Townsend	B	0.67	F	1.07	F	1.36
Fifth/King	C	0.77	F	1.08	F	1.18
Sixth/Brannan	E	0.92	F	1.09	F	1.04
Second/Harrison	E	0.98	E	0.98	F	1.04
Fourth/Harrison	E	0.92	C	0.78	D	0.88
Third/Fourth	C	0.74	C	0.71	C/D	0.80
Seventh/Sixteenth	A	0.52	B	0.62	D	0.89
Division/Potrero	C	0.75/a/	B	0.69	B	0.65
The Embarcadero/Townsend	B	0.60/a/	B	0.69	F	1.02

/a/ 4:00-5:00 p.m. These intersections were not evaluated in VI.E. Transportation.

SOURCES: VI.E. Transportation, Table VI.E.23, p. VI.E.144; and Robert L. Harrison

As stated earlier, impacts from the two stadium/arena scenarios would not coincide exactly with peak commute conditions from 4:00 to 6:00 p.m. By 4:00 p.m., most fans would have departed the stadium under Scenario One; for Scenario Two, few people would arrive in the area by 6:00 p.m. for a 7:30 p.m. event. However, the traffic impacts generated by either of these scenarios would occur close enough to peak-hour traffic conditions that intersection operating levels for an expanded period are presented in this analysis. The projections in Table XIV.M.6 thus present an indication of areas where stadium/arena events, depending on the time they occur, would extend congested conditions beyond those generated during the peak-hour commute. Figure XIV.M.2 indicates the locations and operating conditions of the intersections analyzed.

As shown in Table XIV.M.6, the impact of local traffic generated by major events at the stadium/arena would be substantial for those streets and intersections adjacent to the parking garages and lots which would serve the facilities. As a result, much of King and Townsend Streets, as well as nearby freeway on-ramps, would be further congested during the afternoon commute period. For intersections where volume-to-capacity (v/c) ratios exceed 1.00, congestion would extend beyond one hour if no mitigation measures were incorporated. Mitigation measures are available to improve traffic operations. They are described in the Mitigation section below, pp. XIV.M.26-XIV.M.29.

Most streets and intersections more distant than about one-half mile from the project sites would not experience substantial impacts from stadium/arena-generated traffic. The nature of the grid system of city streets would allow many options for travel paths, enabling drivers to disperse quickly, or arrive from a number of streets. However, this could result in increased travel on streets in surrounding residential neighborhoods such as South Beach or Potrero Hill. Mitigation measures to reduce or avoid potential traffic or parking impacts are presented on pp. XIV.M.26-XIV.M.31.

Parking Impacts

Within a one-mile (25-minute walking) radius of both the stadium and arena sites, there are about 58,600 on- and off-street parking spaces. That inventory of available spaces does not include on-street spaces in residential areas such as those found in the South of Market, South Beach / Rincon Point, Mission Bay or Potrero Hill.

During the weekday, most of the spaces are occupied, about 85%. During the evenings and weekends, more parking is available; about 70-80% of off-street and 50% of on-street spaces are available at these times.

MISSION BAY BOUNDARY
LEVEL OF SERVICE C OR BETTER
LEVEL OF SERVICE D
LEVEL OF SERVICE E
LEVEL OF SERVICE F

Mission Bay

SOURCE: Environmental Science Associates, Inc.; Barton-Aschman Associates, Inc.; and Robert L. Harrison

• FIGURE XIV.M.2
INTERSECTION OPERATING LEVELS BEFORE OR AFTER EVENTS AT THE STADIUM AND ARENA

- In year 2000, the Mission Bay Project Area would still be largely undeveloped. This analysis assumes that lots in Mission Bay, north of China Basin Channel, would provide temporary surface parking or garage spaces for stadium/arena events, in addition to other parking resources within a 15-minute walking radius. For weekday events, an estimated 2,800 spaces in Mission Bay would be available for ballpark/arena visitors. For evening events, approximately 5,600 spaces would be available for ballpark/arena visitors. The greater supply in the evenings reflects lower use levels by Mission Bay employees than those that would occur during weekdays.

- The total number of vehicle trips shown in Table XIV.M.3, p. XIV.M.14, for each scenario determines the parking needed for those who attend stadium/arena events. In addition, stadium/arena staff, VIP visitors, players and team staff (or performers), and the media would require about 500 parking spaces for major events. Space would also have to be available near the stadium and arena to park charter buses. The total parking requirements are compared to parking availability for each scenario studied, in Table XIV.M.7.

TABLE XIV.M.7: TOTAL PARKING REQUIREMENTS AND PARKING AVAILABILITY, STADIUM AND ARENA, 2000•

Scenario	No. of Parking Spaces for Private Vehicles (Stadium/Arena Users and Staff)		
	Requirements	Availability (Within 15-Min. Walk of the Ballpark & Arena)	No. of Required Charter Bus Parking Spaces
Weekday 3:00-4:00 p.m. (Scenario One, Stadium Sellout)	9,600	8,550	75
Weeknight 6:30-7:30 p.m. (Scenario Two, Stadium Sellout and 50% Arena Use)	15,600	19,420	52

SOURCE: Robert Reeves

- For Scenario One, a weekday afternoon sellout event at the stadium, visitors would not be able to find an adequate amount of parking within a 15-minute radius walk (a distance of about three-quarters of a mile) from the stadium/arena to meet full demand. Some visitors would have to seek parking at distances farther than 15 minutes from the stadium/arena. Figure XIV.M.3 provides an approximate indication of a 15-minute walking radius.

  For Scenario Two, arena and stadium events in the evening, an adequate amount of on- and off-street parking would be available within a 15-minute walking distance to meet the needs of visitors, even under the assumption that a higher percentage of them would travel to the area by automobile.

  The areas most affected by stadium/arena parking demand under either scenario would be the Mission Bay Project Area, the South of Market, and Showplace Square. Parking supply in the South of Market is expected to increase somewhat in the future, as a requirement of new development. Most of those additional spaces would be used by employees and residents of that new development. Parking is expected to be more limited east of Fourth Street. Thus, stadium/arena parking demand would likely be directed to areas west of Fourth Street.

- Other more distant areas such as Inner Mission and Potrero Hill could be affected during weekday events, though to a more limited degree than Mission Bay, South of Market or Showplace Square. Some of these areas also would be less attractive as parking resources because of their hilly locations.

- Over the long run, limited parking resources are likely to result in shifts to greater use of public transit or other non-automobile modes, or higher vehicle occupancies (i.e., carpools) to avoid the additional inconveniences and increases in travel time.

Pedestrian Impacts

The stadium/arena would generate a significant number of pedestrian trips. Sidewalks along all major roadway segments such as King, Townsend, Second, Third and Seventh Streets would likely be fully utilized, depending on attendance levels at each location. Pedestrian flows would be espcially heavy at transit stops and stations. CalTrain service from a station at Seventh and Channel Streets would provide almost direct access to the arena site; however, there would still be a substantial walk required for stadium visitors.

MISSION BAY BOUNDARY

15 MINUTE WALKING DISTANCE BOUNDARY

NOTE: This area, about 1/2 – 3/4 mile in distance, would be affected by parking demand generated from events at the stadium and arena. On–street parking spaces in residential areas were not counted in the inventory of parking spaces assumed to be available for the stadium/ arena. The western boundary of the parking radius is generally formed by a line between the intersection of Division and Bryant Streets, and the intersection of Rhode Island and 18th Streets.

Mission Bay

SOURCE: Environmental Science Associates, Inc.; Robert L. Harrison; and Robert Reeves

• FIGURE XIV.M.3
15-MINUTE WALKING DISTANCE TO THE STADIUM AND ARENA SITES

Impacts of pedestrian activity on sidewalks associated with transit trips could be reduced by provision of adequate transit staging areas on both the stadium and arena sites.

YEAR 2020 IMPACTS

Although the stadium/arena facilities are targeted for completion by 1995, their full impacts would not be apparent until after Mission Bay is fully developed, because the year 2000 impacts are predicated on the availability of parking in Mission Bay to meet stadium/arena parking demand. The estimated completion date for Mission Bay is 2020. The discussion that follows addresses how the stadium/arena would further contribute to local transportation issues and impacts that remain to be resolved. In addition, a brief description of cumulative travel conditions is presented to provide the proper context for evaluating local transportation impacts.

VI.E. Transportation, pp. VI.E.166–VI.E.197, presents an extensive analysis of projected conditions on local and regional transportation systems for 2020. It concludes that, without major new additions to our transportation network, travel conditions between 2000 and 2020 would deteriorate to levels that would affect the amount of economic activity sustained by the region.

These conditions would not be attributable to any single component of travel, but to regional travel patterns collectively. Thus, to carry out an analysis in any great level of detail for the stadium/arena in 2020 would be an unwarranted academic exercise.

If travel characteristics were assumed to remain the same, incremental impacts generated by the stadium/arena events in 2020 would be the same as those identified in 2000. However, when impacts are examined in the context of transportation conditions in 2020, there would be identifiable differences from conditions in year 2000 on the local transportation level. Impacts generated by the stadium/arena would contribute to projected cumulative transportation problems, but in such small amounts that they would not generate any change in the types of regional mitigation measures included in VI.E. Transportation, pp. VI.E.224–VI.E.231.

Together with the effects of full build-out of Mission Bay, traffic and ridership impacts of the stadium/arena would result in worse levels of service on local streets and intersections, and public transit, than projected for 2000. A critical difference in impacts generated by the stadium/arena would be related to parking. The build-out of

Mission Bay would greatly reduce or possibly eliminate an important parking resource for the stadium/arena, particularly for events scheduled during weekday afternoons. A theoretical result would have patrons parking much further from the stadium/arena, perhaps more than twice the distances projected for year 2000.

The above conditions are not likely. Overall congestion would likely make ridesharing and transit travel among stadium/arena patrons a more viable alternative, though the levels cannot be determined. To the extent visitors to stadium/arena events travel by more efficient means than private automobile, traffic and parking impacts would be reduced. The magnitude of such modal shifts between 2000 and 2020, however, will also depend on the region's success in providing major expansions in transit and ridesharing facilities.

MITIGATION MEASURES

Traffic Impacts Mitigation Measures

- The impacts of stadium/arena-generated traffic could be mitigated by traffic engineering improvements at the most congested intersections. These improvements would consist of separate left or right turn lanes or the prohibition of turning movements before and/or after events at the stadium/arena. Most would involve prohibition of parking along the affected roadway segments to free up additional roadway capacity to accommodate increased vehicle volumes. Most traffic operation improvements would have low costs and could be easily implemented on a temporary basis. Many of those measures may involve implementation one or two hours before and/or one hour after events at the two facilities.

The improvements listed in Table XIV.M.8 are examples of the kinds of traffic engineering measures which could be implemented at the intersections projected to be most congested due to traffic generated by the stadium/arena. The improvements in Level of Service at the intersections which would result due to these mitigation measures are shown on Table XIV.M.9, p. XIV.M.28. Mitigation measures are indicated for intersections operating at a Level of Service D or worse. The direction of travel flow mitigated by each of these improvements is indicated. "Inbound" refers to trips arriving before stadium/arena events; outbound trips refer to departing traffic after the events have ended. The only intersection for which there would be no adequate roadway mitigation is The Embarcadero and Townsend Street, which is projected to operate at Level of Service F.

TABLE XIV.M.8: EXAMPLES OF TRAFFIC OPERATIONS IMPROVEMENTS

Intersection	Improvements
Third/King	• Provide four lane northbound approach (two through + two right) to facilitate outbound trips following stadium/arena events. This would require coordination with design of the stadium facility site, which would have to provide some space to accommodate this roadway width. • Provide police traffic control before and after stadium events.
Third/Townsend	• Provide three lane westbound (two through + one right) outbound, and three lane eastbound (one through + one through/left + one left) inbound approaches, to facilitate departures and arrivals. Either would require use of a parking lane in addition to the two permanent travel lanes.
Third/Mariposa	• Provide three lane southbound (two through + one right) outbound, and three lane eastbound (one through + one through/left + one left) inbound approaches for departures and arrivals. Both would require use of a parking lane.
Seventh/Townsend	• Provide four lane westbound (two through + two right) outbound, and three lane eastbound (two through + one right) inbound approaches for departures and arrivals. These improvements could require special design treatment in arena building site plans to produce adequate space for the additional roadway width. • Prohibit westbound left turns before and after events at the stadium and arena. Left-turning traffic bound for I-280 (via the Mariposa Street ramps) could be redirected to the Sixth and Brannan Street on-ramp.
Fifth/King	• Provide double southbound right-turn lanes. This would require use of a parking lane. • Prohibit northbound left turn before and after games.
Sixth/Brannan	• Provide four lane eastbound (one through + one left + two right) approach for outbound trips. This would require use of a parking lane.
Second/Harrison	• Prohibit westbound left turn before events for inbound trips.

SOURCE: Robert L. Harrison

TABLE XIV.M.9: MITIGATED IMPACTS, INTERSECTION LEVELS OF SERVICE (LOS) AND VOLUME-TO-CAPACITY RATIOS (V/C), STADIUM AND ARENA, 2000

	Local Street Intersections								Street Intersections at Freeway Ramps					
	Third/King		Third/Townsend		Third/Mariposa		Seventh/Townsend		Fifth/King		Sixth/Brannan		Second/Harrison	
Scenario	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Weekday 3:00 – 4:00 p.m.														
Without Stadium/Arena	C	0.71	A	0.41	NA	NA	A	0.50	B	0.61	C	0.77	C	0.76
With Stadium Sellout and No Arena Use	E	0.92	E	0.98	NA	NA	F	1.07	F	1.08	F	1.09	E	0.98
Mitigated Impacts	D	0.88	B	0.67	NA	NA	C/D	0.80	E/F	1.00	E	0.93	D/E	0.90
Weeknight 6:30 – 7:30 p.m.														
Without Stadium/Arena	A	0.56	A	/a/	A	/a/	A	/a/	A	0.50	B	0.61	B	0.60
With Stadium Sellout and 50% Arena Use	F	1.49	E	0.94	F	1.02	F	1.36	F	1.18	F	1.04	F	1.04
Mitigated Impacts	F	1.16	C	0.74	B/C	0.70	D	0.87	E	0.93	F	1.02	D	0.84

NA – Not applicable.

/a/ V/C is less than 0.50

SOURCE: Robert L. Harrison

The kinds of traffic operations improvements listed in Table XIV.M.8 could significantly reduce congestion at the intersections indicated. With the exception of the intersections immediately adjacent to the stadium, the stadium/arena-generated traffic when added to traffic from other developments would not substantially exceed the capacity of the improved intersections. Most intersection Volume-to-Capacity Ratios would be about 1.0 or less if the mitigation measures were fully implemented. This means that severe congestion would last for no more than about an hour at most intersections, even for sellout events at the stadium.

Intersections where severe congestion would last for more than one hour before and after sellout events even with the suggested traffic operations improvements would be King Street at Third and Fifth Streets. Traffic volumes at these intersections would be 20% to 30% over capacity. Police traffic control would be needed on King Street to provide the most efficient traffic flows possible before and after sellout events.

In addition to traffic engineering measures at the most congested intersections, a separate category of mitigation measures could be employed on streets in residential neighborhoods. Streets in neighborhoods such as South Beach, Potrero Hill and Mission Bay could be restricted to local traffic. Through traffic going to or from the stadium/arena could be prohibited on streets in these residential neighborhoods, through the use of street barriers and/or police control services. This would restrict the impacts of stadium/arena traffic to those main streets and thoroughfares where traffic engineering solutions could be sought to mitigate impacts.

The City should continue to encourage greater use of access modes other than the automobile and thereby directly reduce the amount of traffic which would be generated by the stadium/arena.

- To provide an adequate and safe pedestrian network to serve the ballpark and arena facilities, overhead crossings could be provided to maintain separation between pedestrian and auto travel. Among various locations that may be considered, the following should receive high priority: over Third Street, south of King Street; over King Street, west of Third Street; and over King Street, east of Third Street (which also should include a branch exit to the MUNI Metro platform). The design of such crossings would likely need to be integrated into the design process for the ballpark/arena facilities, and components of Mission Bay development that would be located in those areas.

Parking Mitigation Measures

Parking demand generated by the stadium/arena would in many cases exceed the parking supply proposed on the two sites. The measures below identify how off-site parking resources could be made available for use by stadium/arena visitors.

- The stadium/arena project would require space for charter bus parking in addition to parking for private cars. This space could be provided on the Port of San Francisco lands near Piers 48 and 50 for stadium buses and on the City-owned Channel Street right-of-way near the arena site.

  Several kinds of parking programs could be developed as part of the stadium/arena project. The Mission Bay project will be constructing parking garages near the stadium/arena sites. Joint use of these Mission Bay garages could be planned as part of the stadium/arena project. Agreements with other private parking facilities to tie specific parking spaces to particular seats at the stadium and at the arena could be developed as part of the parking program for the stadium/arena project. Such a program has been used successfully in Vancouver, B.C., where users of the downtown stadium receive a specific privately operated parking place identified by location and price when they purchase a ticket to an event at the stadium.

  Other innovative concepts such as a "parking boat" could also be explored. Oceangoing auto carriers have been used successfully as auxiliary parking facilities in Japan. Such a parking boat might be permanently docked near the stadium or could be brought in to serve the area during the baseball season and stored or used elsewhere in the off-season. Such an arrangement would be subject to approval by the Bay Conservation and Development Commission.

- Residential neighborhoods near the stadium/arena could be protected from the parking demands of the project by neighborhood parking sticker programs. Streets in the South Beach, Potrero Hill and Mission Bay neighborhoods could be restricted to parking for residents and guests only. Parking sticker programs have been successful in other City neighborhoods and could be used to prevent stadium/arena impacts on nearby residential neighborhood streets and parking needs. Another measure that could be considered is the installation of parking meters in residential areas that exempt residents (with parking stickers) from paying, but not ballpark/arena or other visitors. These measures would require strong parking enforcement to be successful.

- In order to maintain a relatively constant parking supply within a 15-minute walking distance, a parking overlay zone could be legislated for inclusion in the City Planning Code to require that new development replace any parking that is displaced.

In response to growing congestion and parking demand over the long term, the City will need to continue to increase the use of public transit, charter bus, rideshare, walking and bicycling to the stadium/arena to reduce the need for parking.

Public Transit Mitigation Measures

The stadium/arena project should be designed with public transit access requirements as a high priority. Large and efficient loading areas for transit buses, charter buses and taxis should be a mandatory design requirement. Priority routes for public transit vehicles should be identified to allow the efficient movement of these vehicles to and from the stadium and the arena.

The Municipal Railway would have to handle over 7,000 riders in the hour following a sellout event at the stadium. The MUNI Metro extension would have stops at Second and King Streets adjacent to the stadium, and at Sixth and King Streets adjacent to the arena. The Metro is expected to serve about half of the MUNI's total stadium-generated patrons. The stops on the Metro should be designed as high-capacity stations able to handle large peak loads. Pedestrian access to the Metro stations should be physically separated from street-level vehicular traffic.

- Access routes for surface transit vehicles should be kept clear of competing auto traffic in order to assure efficient loading and departure of public transit vehicles. Streets which should be totally or partially reserved for transit vehicles before and after events include portions of Second Street or Third Street north of King Street, Berry Street toward the west, and portions of China Basin Street and Third Street, south of China Basin Channel.

AIR QUALITY

Just as the Mission Bay Alternatives, providing more-intensive use of the Project Area than assumed under the 1982 Bay Area Air Quality Plan, are inconsistent with that Plan's land use projections, so too the addition of the stadium and the arena are inconsistent with those projections, and therefore with the Plan itself. The major air-quality

impacts of the stadium/arena would result from increased local and regional vehicular traffic. During the smog season (late summer and fall), the increased emissions would contribute to ozone standards violations east and south of San Francisco. Total countywide emissions of criteria pollutants would be greatest when the stadium/arena vehicular emissions are added to those under Alternative A, as the Mission Bay emissions from Alternatives B and N have been projected to be 60% and 70%, respectively, of those from Alternative A. This analysis is conservative in that there has been no adjustment to deduct the vehicle emissions that have been generated by activities at Candlestick Park, which are already included in the County-wide cumulative base. As the emissions from stadium/arena traffic would be added to the countywide cumulative base, the Mission Bay Alternative emissions per se would become smaller percentages of countywide totals than the numbers presented in Table VI.F.3 in VI.F. Air Quality, p. VI.F.14.

Locally, the cumulative impacts of the stadium/arena would reflect the increased emissions of carbon monoxide (CO) along congested streets and at congested intersections. VI.F. Air Quality states that no violations of state or federal CO standards are expected under any of the Alternatives in 2000 or at build-out. Table XIV.M.6, p. XIV.M.19, shows that for Scenario One (afternoon stadium sellout), between 3:00 and 4:00 p.m., most analyzed intersections would have somewhat worse Levels of Service (higher volume/capacity ratios) than those during the 4:30-5:30 p.m. peak hour (without the stadium) for Alternative A. For Scenario Two (evening stadium sellout, evening arena half-capacity event), between 6:30 and 7:30 p.m., most analyzed intersections also would have worse Levels of Service (higher volume/capacity ratios) than those during the 4:30-5:30 p.m. peak hour (without the stadium/arena) for Alternative A. However, in neither scenario would the increased traffic volumes cause the one-hour CO standard to be violated.

The main effect would be on the eight-hour CO concentrations, because either scenario would extend the duration of congested conditions at local intersections: forward into mid-afternoon in Scenario One, or later into the evening in Scenario Two. The additional traffic volumes could cause violations of the eight-hour CO standard, if the traffic levels produced by Scenario One or Scenario Two were to occur at a time of worst-case meteorology, the basis of the carbon monoxide calculations in VI.F. Air Quality, pp. VI.F.13-VI.F.19. That worst-case meteorology is essentially a winter-season phenomenon, resulting from the lower wind speeds and the nighttime radiation inversions that occur in the winter season. Therefore, an eight-hour CO violation is most likely to occur if there is a special (non-baseball) sellout event at the stadium during the winter months.

The local baseball season runs from about mid-April to no later than mid-October, before the start of the winter CO season. In Scenario One, vehicular traffic is generated entirely by the maximum 45,000 baseball patrons; in Scenario Two, four-fifths of it is generated by those patrons. Thus, Scenarios One and Two are spring/summer/fall occurrences. As stated earlier in the transportation discussion, these attendance scenarios are conservative given that baseball sellouts would be expected only a few times a year. During the winter season when a sellout event in the open-air stadium would be even less likely, sellout events at the arena would be the main activity in the area. With a maximum of 20,000 persons attending a 100%-capacity event at the arena, the maximum additional traffic volumes in the winter months would be substantially less (by 50-60%) during the peak CO season than the additional volumes indicated in the stadium/arena columns in Table XIV.M.6, p. XIV.M.19.

A second reason why violations of the eight-hour CO standard are unlikely is that the main contributor to local CO levels in urban areas is the local background, rather than the additional traffic on specific streets or at specific intersections. Table VI.F.4, in VI.F. Air Quality, p. VI.F.18, shows that the local background contributes about 60-90% of the total CO level at an intersection. Therefore, increases in intersection concentrations of CO are much less than proportional to increases in intersection traffic volumes.

Mitigation measures for air-quality impacts would be those which reduce vehicle trips, described previously in Transportation, pp. XIV.M.26-XIV.M.29 and p. XIV.M.31.

NOISE

The stadium is targeted for completion by 1995. There would be little Mission Bay development by that time. Therefore, the major impacts of stadium construction noise would be felt by existing residential land uses, such as in the South Beach Redevelopment Area. The arena would also presumably be built in the early years of Mission Bay development, so that its construction-noise impacts on proposed Mission Bay residential uses would be minimal.

Existing noise from maritime and other commercial/industrial operations in the land uses to be displaced by the stadium (chiefly from freight loading/unloading, as described in VI.G. Noise, p. VI.G.6 and p. VI.G.25) would disappear.

The stadium, open to the sky, would be a source of noise to surrounding uses. With a height of at least 100 feet, and possibly up to 150 feet, the top of the structure would be above the top levels of nearby residential buildings in Mission Bay (a maximum of eight stories, with variants up to ten stories). Therefore, there would be no direct (unshielded) path for crowd noise or amplified announcements to reach residents in Mission Bay. However, the top of the stadium structure would be below the upper levels of the 14-story residential complex in South Beach, and intervening buildings are all lower than six stories. Therefore, residents in those upper levels would be exposed to direct-path crowd or loudspeaker noise.

- Without detailed design information on the stadium structure, it is not possible to estimate additional impacts of reflected or structurally attenuated noise, which might be noticeable in other portions of Mission Bay, the South of Market, or possibly Potrero Hill. If the upper levels of the main structure were open below the roofline, more off-site receptors would be exposed to direct-path noise than if the structure were of solid construction up to its roofline. Also, if the stadium were not the same height around its entire perimeter (for example, if the outfield structure to the east of the field were open or lower than the structure at the home-plate end), some crowd or loudspeaker noise could have a direct path toward the east; i.e., toward the projected South Beach public park east of Second Street, the existing waterfront promenade and public access and fishing areas along the boat harbor breakwater, the Bay itself and the South Beach Marina, and toward the easterly end of the proposed Mission Bay open space in Alternative A (wetland in Alternative B). Under those circumstances, more levels in the 14-story South Beach residential complex could be exposed to direct-path crowd or loudspeaker noise. In general, crowd and loudspeaker noise from evening ballgames at the stadium would be more noticeable than noise from daytime events, because the background noise levels in the evening would be lower than normal daytime noise levels, and because more residents would be at home in the evening than in the afternoon. Closed windows would attenuate outside noise; however, residents would be exposed to outside noise when they were outdoors, or indoors with windows open. In general, residents closest to the stadium or the arena would experience the highest noise levels from them. Intervening structures, including the China Basin Building, would provide partial shielding for residents and employees in the Mission Bay, South of Market and South Beach areas.

- An additional source of noise would be the crowds of up to 45,000 fans leaving the stadium after a baseball game. The impact would be greatest following a capacity night

game, when many nearby residents would be asleep. Pedestrians themselves would be noisy as they left the stadium; motorists leaving garages and on-street parking spaces might blow their horns as they depart. Mitigations for these impacts, such as additional sound insulation in surrounding buildings, could be needed, and would be considered in any project-specific environmental review of a ballpark if the impacts were found to be potentially significant.

When the stadium is under consideration by city decisionmakers, the sponsor could be required to carry out a noise study, and implement the mitigations suggested by it. Noise shielding (for example, a solid wall up to the roofline) could be imposed as a mitigating condition of project approval.

Because the arena would be a fully enclosed structure, events there would not be expected to produce similar noise impacts on surrounding uses. It should be noted, however, that the Oakland Coliseum arena contains a completely surrounding glass wall at its upper levels; that kind of construction would provide less noise attenuation than conventional wall construction. As with the stadium, the sponsor could be required to carry out a noise study, and implement the mitigations suggested by it. Noise shielding (for example, a solid construction wall up to the roofline) could be imposed as a mitigating condition of project approval.

VI.G. Noise notes that traffic noise impacts differ little among the Mission Bay Alternatives. The stadium/arena local traffic increases shown in Table XIV.M.6, p. XIV.M.19, would contribute to increases in noise levels along local streets. At and near the p.m. peak hours, those increases would be imperceptible when compared to those predicted for Alternative A; it would take almost a doubling of traffic volumes above those predicted for Alternative A to produce a noticeable change. However, under Scenario Two, the additional traffic after stadium and arena events (after 10:00 p.m.) would increase the local Community Noise Equivalent Level (CNEL) <u>and</u> the day-night (L_{dn}) noise levels, and the additional traffic before those events (after 7:00 p.m.) would increase the local CNEL, thus making the areas north of China Basin Channel and possibly along portions of Third Street more incompatible for housing development than indicated in VI.G. Noise, and potentially requiring further noise-reduction construction measures in housing development. (See Volume One, p. II.59, for explanations of CNEL and L_{dn}, and the expected noise compatibility of housing in Alternatives A and B.)

ARCHITECTURAL RESOURCES AND URBAN DESIGN

- The stadium, 100-150 feet in height, would be a massive structure compared to the one-to-two-story maritime and other commercial/industrial structures now on the site. It could be the single tallest structure in the area, visible from many points in Mission Bay, the downtown, and the South of Market area, as well as from more distant neighborhoods such as Potrero Hill. The 76-foot-tall China Basin Building just west of the ballpark site also is visible from these points. The arena, 100-120 feet in height, would also be more massive than the 30- to 60-foot S/LI/RD structures proposed on that site under Alternative A. The elevated I-280 structure would be between the arena and the office/residential uses to its east and the southeast. However, upper levels of nearby eight-story Mission Bay structures and some warehouses in Showplace Square and South of Market would have a direct line of sight to the upper levels of the arena.

  Both the stadium and the arena, having heights of 100 feet or more, could redirect wind flows around them and divert wind downward, substantially increasing wind speed and turbulence at street level, and thereby degrading the environment for nearby pedestrians. Mitigation would include evaluation of wind effects during design of the stadium and the arena, and appropriate design, as necessary to reduce wind impacts to tolerable levels.

- During the morning hours, the stadium could shade the east-facing walls of the proposed Mission Bay structures on the west side of Third Street, between Townsend and Berry Streets (office buildings in Alternative A, residential buildings in Alternative B, office and industrial buildings in Alternative N). In the afternoon, shadows from the stadium would be cast eastward toward the Bay. Areas shaded could include the projected South Beach public park east of Second Street, the waterfront promenade, and the public access and fishing areas on the marina breakwater. At other times, the stadium might shade more distant open-space areas. During the afternoon hours, the upper levels of the arena structure could shade the west-facing walls of Mission Bay structures east of Sixth Street, between Townsend and Berry Streets (offices and residences in Alternative A, residences in Alternative B, industrial buildings in Alternative N). Also during the afternoon hours, the upper levels of the arena structure could shade the open space beyond the I-280 freeway structure, on both sides of China Basin Channel. Mitigation of impacts on open space areas could consist of application of design guidelines and criteria, such as those in San Francisco's Sunlight Ordinance.

The major impact in this environmental category would come from the field lighting system that would be an essential element of the stadium operation. Conventionally, the lights are elevated and surround the playing field. At Candlestick Park the lights, roughly at the corners of the stadium structure, are on poles rising immediately outside the structure. The lights are at an elevation about twice the height of the structure itself. Because they must illuminate the entire playing field, stadium lights are extremely powerful and have fairly high beam widths.

- Night illumination of outdoor areas can affect sensitive receptors in several ways. The brightness of the light source (i.e., its intensity) can cause glare when the light source is viewed directly; this is the effect people experience if they attempt to look directly at the sun or bright lights. Glare from artificial lighting is more common at night than during the day, because of the extreme contrast between the intensity of the light source and the general intensity of the landscape. Generally, stadium lamps are of high intensity, can have considerable beam widths, and are oriented about 22 degrees to 45 degrees down from the horizontal, so the light from several lamps can be visible at the same time from many off-site areas within the viewshed.

Light sources can also annoy people at night when the light source is not viewed directly. Where intense lighting is viewed against a dark background, the contrast attracts the attention of the viewer and could be considered annoying. Under low-light conditions, the human eye adjusts to the brightest light within view. If the range of light intensity to which the eye is exposed is large, the eye will be relatively and temporarily insensitive to the more dimly lighted portions of the landscape. In addition to being annoying, this can create unsafe nighttime conditions for drivers and pedestrians.

That kind of distraction can be illustrated by a few examples. The effect of lights at Candlestick Park on drivers on U.S. 101 is mainly on the peripheral vision. The lights at Bay Meadows Racetrack in San Mateo can be seen from as far away as the Hayward approaches to the San Mateo Bridge, where they are a major element in the direct field of view of motorists westbound on Highway 92. The distracting effect, requiring extra concentration by drivers to see the road ahead, continues for most of the trip across the bridge.

Night lighting increases average illumination levels in spillover areas (areas beyond the playing field and the stadium structure). Increased illumination can affect the suitability of sleeping areas, use of outdoor areas at natural light levels, and privacy. Such impacts

need not involve direct glare effects. For some types of activities, such as sleeping, the degree of impact is probably related to the degree of change from the illumination levels to which people have become accustomed. Residential and recreational areas are considered to be the most sensitive receptors for light-producing activities.

If the new stadium lights are at an elevation of about 200 feet, such as is the case as at Candlestick Park, they would be visible throughout much of the Mission Bay area. They could be distracting to motorists northbound on the elevated I-280 structure, and possibly to those on the new King Boulevard off-ramp, depending on the timing and the height of intervening development. However, current lighting design standards for new outdoor sports facilities generally do not involve lighting installations at such great heights, which could reduce the amount of glare spillover.

The lights could also be visible and annoying to residents on the upper levels of Potrero Hill, as the stadium lights would appear brighter than the lights on the Bay Bridge beyond, and the headlights of approaching Bay Bridge traffic. The stadium lights could be visible and annoying to residents of the South of Market and downtown areas, wherever high-rise office buildings do not block the light path.

In addition, skyglow would result occasionally, because of the presence of fog, which occurs frequently in San Francisco during evening hours throughout the year. Skyglow, resulting from reflectance and scattering by the fog, would be visible for several miles, although by its nature it would be less intense and have less direct spillover illumination than the glare under fog-free conditions.

Mitigation could consist of careful design and operation of the stadium lights, with emphasis on minimum required intensities, and maximum direction of the light to the playing field, with minimum spillover beyond the stadium. State-of-the-art lighting fixtures and design are available to achieve this. It would be possible for lights on the stadium to be below 200 feet in height, using bulbs that would produce a more focussed light than currently provided at Candlestick Park. Reduction of spillover light can be further accomplished by minimizing the angle of light beams to focus lighting on the field, rather than outside the stadium facility. Furthermore, any structural shielding around the lighting sources would mitigate glare impacts.

GEOLOGY AND SEISMICITY

In a major earthquake, groundshaking would be "violent" at both the arena and the stadium sites (VI.K. Geology and Seismicity, p. VI.K.33). The major impact of stadium/arena operations would be the exposure of a large number of additional people in the area to the effects of a potential earthquake, thus adding to the number of injuries and fatalities, and to the demands on emergency service providers.

Table VI.K.4, in VI.K. Geology and Seismicity, p. VI.K.38, provides the following relevant population statistics under Alternative A, at build-out:

Residents	15,000	
Employed		8,700
Unemployed		5,600
Employees	26,000	
2:00 a.m. Population	15,000	
2:00 p.m. Population	31,000	
Evening Population (implied)	15,000	

Scenario One would add 45,000 people to the 2:00 p.m. population, zero to the evening or the 2:00 a.m. population. Thus, on days on which there was an afternoon stadium sellout, the afternoon population in the area (including the stadium site) would more than double.

Scenario Two would add 55,000 people to the evening population, zero to the 2:00 p.m. or the 2:00 a.m. populations. Thus, on evenings with a stadium sellout and a 50%-capacity event at the arena, the evening population in the area (including the stadium site) would more than quadruple.

In no event would the nighttime (2:00 a.m.) population be increased by the stadium/arena project.

Should a major earthquake occur at a time when there were large crowds at the arena and/or the stadium, estimates of injuries and deaths in VI.K. Geology and Seismicity, Table VI.K.4, p. VI.K.38, would be expected to increase in at least the proportions of the population increases described above. However, the situation would probably be worse. In an earthquake, the presence of large excitable crowds, concentrated in one or two structures, could cause more panic, with resulting pile-ups of people, trampling, etc., than would be expected in conventional buildings.

Mitigation measures could include the range of structural and emergency-response measures provided in VI.K. Geology and Seismicity, pp. VI.K.45-VI.K.56, with special planning for crowd control at the arena and the stadium. The arena could be designed and equipped as a mass-care facility, as in Mitigation Measure K.19, described in VI.K. Geology and Seismicity, p. VI.K.54.

NOTES - Sports Facilities

/1/ Employment estimates based on interviews and estimated building areas, using density factors shown in Table XIV.A.2, pp. XIV.A.10-XIV.A.12, in the Mission Bay EIR, Volume Three, San Francisco Department of City Planning (86.505E).

/2/ Employment estimate is based on a ratio of employees to building area, derived from interviews.

/3/ Margaret Divine, P.E., Project Manager, San Francisco Department of Public Works, telephone conversation, July 18, 1989.

/4/ Frank Cannizzaro, San Francisco Redevelopment Agency, telephone conversation, March 29, 1990.

/5/ The concept of screenlines is used to describe the magnitude of travel from or to San Francisco's Downtown & Vicinity (which includes the proposed stadium/arena sites), to compare estimated travel volumes by mode of travel to capacities available for each mode. Screenlines are hypothetical lines that would be crossed by persons traveling between the Downtown & Vicinity and other parts of San Francisco and the region. They are therefore the measurement points for the cumulative travel projections presented in this analysis. For more detailed information on the function and location of screenlines, see VI.E. Transportation, p. VI.E.31.